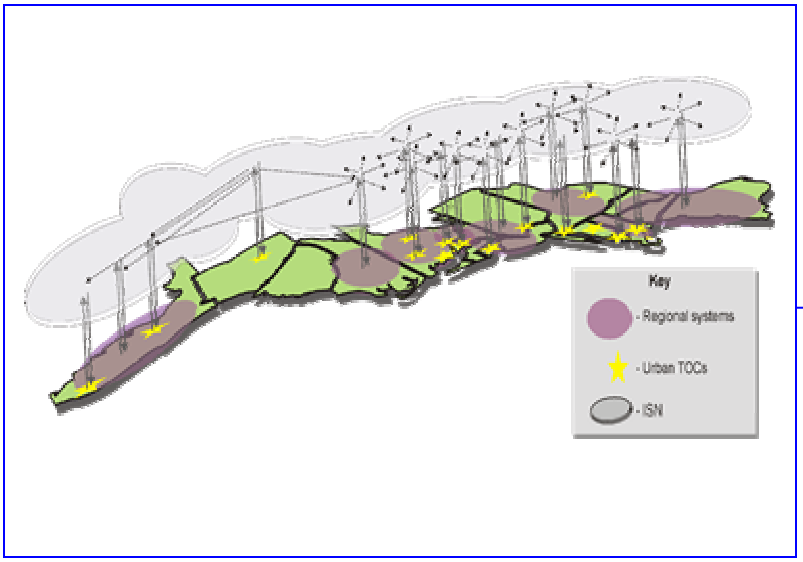


# I-95 Corridor Coalition

# Information Systems Network
## *Concept of Operations*

I-95 CORRIDOR COALITION

***September 2005***

# Information Systems Network
*Concept of Operations*

*Prepared for:*

I-95 Corridor Coalition

*Sponsored by:*

I-95 Corridor Coalition
(DOT's, etc.)

*Prepared by:*

Mixon/Hill, Inc.

***September, 2005***

This report was produced by the I-95 Corridor Coalition. The I-95 Corridor Coalition is a partnership of state departments of transportation, regional and local transportation agencies, toll authorities, and related organizations, including law enforcement, port, transit and rail organizations, from Maine to Florida, with affiliate members in Canada. Additional information on the Coalition, including other project reports, can be found on the Coalition's web site at http://www.i95coalition.org.

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**Revision History**

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# 1 SCOPE

## *1.1 Identification*

This document provides a Concept of Operations (ConOps) for the I-95 Corridor Coalition (CC) Information Systems Network (ISN). The ConOps document provides describes the current state, establishes the case for change, and describes the proposed system in terms of its features and operations.

## *1.2 Document Overview*

The remainder of this document consists of the following sections and content:

**Section 2 (Current Systems)** of the ConOps describes the current situation with respect to the systems (either automated or manual) as they currently exists. When systems or functionality do not currently exist, the document describes the situation that motivates development of the proposed system.

**Section 3 (Justification for and Nature of Changes)** of the document describes the justification for and nature of the proposed changes. This section identifies deficiencies of the existing situation and the benefits of change.

**Section 4 (Concepts for the Proposed System)** describes the proposed system that results from the desired changes. This is, necessarily, a high-level description, indicating the operational features of the system when fully deployed. This represents a long-term vision, not a description of the initial deployment.

**Section 5 (Operational Scenarios)** of the ConOps contains operational scenarios for the system. A scenario is a step-by-step description of how the proposed system might operate and interact with its users and its external interfaces under a given set of circumstances. The scenarios tie together all parts of the proposed system, the users, and other entities by describing how they interact.

**Section 6 (Summary of Impacts)** of the document describes the operational impacts of the proposed system on the users, the developers, and the support and maintenance organizations. This section may also identify temporary impacts on participants in the deployment that are a direct impact of transition from the old system(s) to the new system.

**Section 7 (Analysis of the Proposed System)** provides a discussion on the benefits, limitations, advantages, disadvantages, and alternatives and trade-offs considered for the proposed system. In the context of this document, alternatives are operational alternatives and not design alternatives (which are considered in the Systems Engineering Analysis.)

**Appendix A** (Definitions, Acronyms, and Abbreviations) provides definitions for the terms, acronyms, and abbreviations used throughout the document.

**Appendix B** provides an extensive list of references for the document.

## *1.3 System Overview*

The I-95 Corridor Coalition and its members have sponsored and participated in a variety of initiatives to facilitate sharing operations information between agencies.

Some of these systems were the subject of a study[1] undertaken by the Coalition in 2004 to provide a rapid assessment of existing information sharing and analysis tools in anticipation of developing an Information Sharing Network (ISN) for the Coalition membership. The express purpose of the ISN is to provide the ability to share event information between systems across all transportation agencies operating along the corridor.

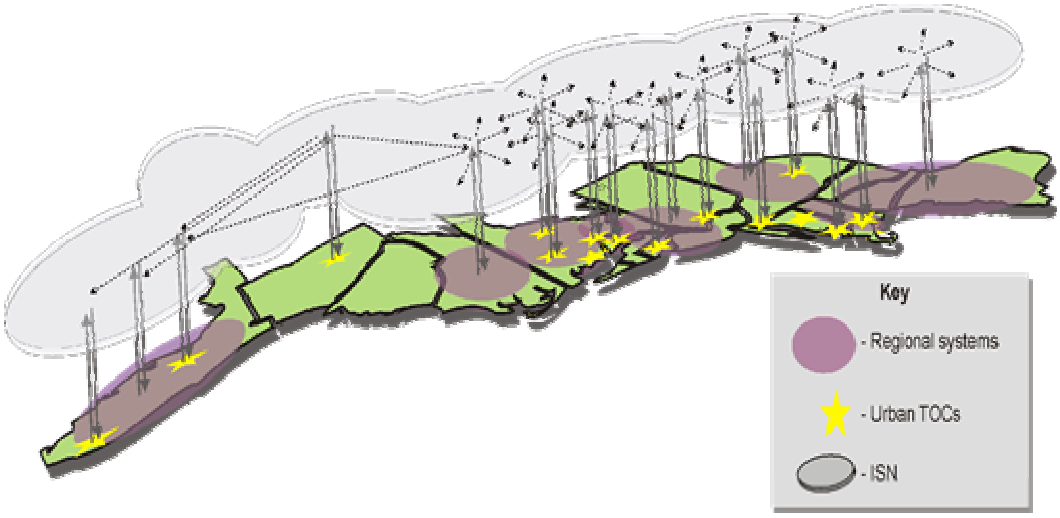


**Figure 1 - The ISN Concept**

The ISN will fundamentally be a network of transportation information services. It will not be a single new information center, or a dedicated workstation, or a specific software package to be distributed to ISN users. The network will consist of the existing systems along the I-95 corridor, with new standardized interfaces, and of new management components, administrative interfaces, and policies needed to make it coherent and cohesive. The existing systems, the new management components, and user interfaces will all be services on the ISN.

[1] I-95 Corridor Coalition, *An Assessment of Existing Information Sharing and Analysis Tools,* May 28, 2004.

# 2 THE CURRENT SYSTEMS

This section describes the current systems (automated and manual) as they currently exist.

## *2.1 Background, Objectives, and Scope*

Travelers want and need information about major incidents and events along their route of travel. These routes, even for routine travel, may run through multiple states and segments of control. Travelers are therefore challenged to know where to look for information at any particular point along their route.

Transportation system operators need access to information about conditions within the systems for which they are responsible in order to keep the system operating smoothly and safely. The system's behavior, however, may be influenced significantly by events beyond the system's borders – outside the region controlled by those operators. Information from nearby systems may be as important to system operations as is information from the system itself. This is particularly true for managing incidents, emergencies, and disasters that threaten traveler safety.

The traveler's and operator's need for information is sensitive to time as well as geography. Knowing which route has the shortest average travel time is not helpful if an incident has it shut down while the traveler is in route. Travelers need information from operators that is timely – relevant to the timeframe in which they make a travel decision. Access to this *real-time* information is critical to the traveler's safety and mobility.

Transportation system managers have responded to these needs by building a variety of systems to acquire, analyze, publish, and distribute information about the state of their systems. System operators generally have means to monitor roadways commensurate with their need to control the traffic and provide information needed for incident and emergency response within their sphere of control. Travelers in most locations have a variety of sources for local traffic information.

## *2.2 Operational Policies and Constraints*

In the current operating environment, operators and travelers are constrained by the lack of information about travel conditions beyond the region in which they are currently operating or traveling. Some information about other regions might be available on Internet sites or through existing media channels, if those are accessible , but they will not necessarily put the information in the context of the traveler or operator's need.

Operators may also be constrained by the lack of any formal means to communicate data to adjoining systems. Unless long-term cooperative agreements are in place with nearby agencies, information sharing is likely to be on an as-needed basis.

## *2.3 Description of the Current Systems*

The following section describes systems that currently exist along the I-95 corridor. This is not a comprehensive overview of all systems, but is a representation of the different types of systems that exist. These systems cover local, regional, and multi-state areas.

### 2.3.1 Early Coalition Projects

#### *2.3.1.1 I-95 CC Project 6: User Needs and Marketability of Traveler Information*

Under this project, surveys were conducted of various users throughout the corridor in order to determine traveler information needs and their willingness to pay for services. The study also identified the market potential for the selected information systems and institutional issues and barriers to bringing information to the commercial market.

The user group included automobile users, business and recreational travelers, commercial vehicle operators, local transit, inter-city rail, and air travelers. Various stakeholders interviewed included manufacturers, electronic and telecommunication companies, transportation agencies, and media. Data and information was collected from these groups through focus groups, telephone surveys, on-site surveys, and individual interviews.

Surveys revealed that auto travelers along the Corridor considered information on weather, construction activities, traffic conditions, and alternate routes to be important. Transit travelers considered information on weather, schedules, delays, connections, and arrival times to be important. In general, travelers indicated a willingness to pay minimal fees for traveler information services if they were better than existing systems. Survey results also indicated that barriers to partnerships and information sharing were being resolved with organizational, regulatory, and administrative changes.

The overall results, observed by the completion of this project, indicated that travelers do change their travel behavior if information about travel conditions is available. Despite some hesitation to pay for travel information services, the potential market size for Advanced Traveler Information System (ATIS) products and services was substantial.

#### *2.3.1.2 I-95 CC Project 8: Traveler Information Services*

The Traveler Information Services project was initiated to develop an implementation plan for a Corridor-wide Traveler Information System (CTIS) using state-of-the-art and cost effective technologies. Traveler information services would provide information to Corridor users for pre-trip and real-time planning purposes.

The recommended CTIS focused on providing travel information in vehicles, homes, the workplace, public kiosks, and intermodal transfer points. The proposed architecture identified several Regional Traveler Information Centers (RTIC), each requiring public or private partnerships. Traveler information would be provided to these RTICs by agencies in the region.

Upon completion of this project, the recommended Regional Traveler Information Centers were not implemented. Coalition members felt the capital investment in facilities and hardware was not practical. However, as agencies continued implementing Intelligent Transportation Systems (ITS), results from this project were considered very helpful.

### 2.3.2 Current Coalition Projects

#### *2.3.2.1 I-95 CC Development of the Integrated Corridor Analysis Tool (ICAT)*

Originally, the purpose of the Integrated Corridor Analysis Tool (ICAT) project was to develop a Corridor-level management tool that would provide information on corridor-scale travel patterns and travel times and serve as an analysis tool for member agencies to make decisions on operations, ITS, and capital investments.

As the project developed, it became apparent to Coalition members that the assignment was too large to complete in one project. A consensus was reached that the next phase of the project would focus on the development of the Geographic Information System (GIS) database that will support planning activities throughout the I-95 Corridor Coalition. Objectives of the ongoing network development effort include: developing a linear referencing system for relating to locations along the network, developing a database relationship between the geographic referencing system and each state's road inventory database or transportation model network, and populating the network with roadway characteristics from each of the states.[2]

#### *2.3.2.2 I-95 CC Intermodal Passenger Travel Information System Project*

This project is a multi-phase effort to implement a corridor-wide intermodal traveler information system including intermodal trip itinerary planning that is high quality, low cost, and easily accessible. The system is intended to provide travel information for long distance and intercity travelers extending from Maine to Florida.

Phase I of the project explored the feasibility and opportunities for a corridor-wide trip itinerary planning system, identified several options, and recommended further investigation of an approach for deployment. Phase II further investigated the market and operating alternatives for a system, presented recommendations for the operating framework and development, and defined requirements for prototypes and the recommended business model. The current combined work program for the project has three elements: rural mapping and web-based transit itinerary in Maine; integration of web-based trip planning activities for geographically adjacent transit agencies; and a module to provide integrated public transit oriented ground transportation information to the air traveler.

[2] I-95 Corridor Coalition, *Network Development Scope of Work*. March 17, 2004.

#### *2.3.2.3 The Information Exchange Network (IEN)*

The Information Exchange Network was developed to fulfill the Coalition member agencies need for an electronic communication/information exchange network. The IEN was developed as a client/server application supporting member agencies in the New York, New Jersey, and Connecticut regional area and was connected through dial-up service. Functions of the IEN included data and maps in a graphical environment for inputting and displaying current information.

While the IEN was being developed, Coalition agencies expressed a desire to designate a central location where information could be collected and disseminated for those incidents having regional impacts. The Transportation Operations Coordinating Committee (TRANSCOM), an agency that was formed in the early 90's to assist in responding to incident dissemination needs in the New York City metropolitan area, was asked to provide those services.[3]

In 1998, the TRANSCOM Regional Architecture was developed to provide regional coordination in incident detection and incident sharing. The Regional Architecture is integrated with the TRANSCOM System for Managing Incidents and Traffic (TRANSMIT), which provides real-time travel time and incident alerts using Electronic Toll Collection (ETC) probe data, and Trips 123 system, which provides traveler information and transit trip planning. The Regional Architecture allows integration and distribution of GIS and mapping data and services.

The development of the IEN is an ongoing project. In most recent events, the Regional Architecture is being changed from a client-server based application to a web based application; known as the Regional Architecture (RA) Web Interface. "The RA Web Interface will allow users to create, update, close, receive, and distribute Regional Architecture incident, construction, special events, link data, object data, as well as view them on a map interface."[4]

#### *2.3.2.4 Assessment of Existing Information Sharing and Analysis Tools Report*

The purpose of this project was to evaluate existing Information Sharing and Analysis Tools in use by Coalition members and others in an effort to develop an Information System Network Concept of Operations and Architecture for a system that would allow Coalition members to share information between traveler information systems, support real-time transportation management and operations, and store information that may be used by travelers or public agencies. Only systems with the ability to operate at a Corridor-wide level were considered in the assessment. The assessment focused on the following five systems:

- The Condition Acquisition and Reporting System (CARS);
- The Intelligent Road/Rail Information Server (IRRIS);

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[3] I--95 Corridor Coalition, Reports and Projects, *Interagency Communications.* <http://www.i95coalition.org>.

[4] PB Farradyne, *Regional Architecture Web Software Functional Requirements*. January 14, 2005

- The TRANSCOM Regional Architecture;
- SmartNET; and
- The Evacuation Traffic Information System (ETIS).

These systems serve to gather, share, and display information, and do not function as predictive, real-time, or historic data analysis tools. Therefore, the consulting team included a brief assessment of the ITS Deployment Analysis System (IDAS).

Results from the assessment revealed that it would not be possible to establish the proposed information sharing and analysis tool using any of the existing systems. At the completion of the project, the consulting team recommended that the Coalition further pursue the proposed system by: establishing a working group dedicated to this effort, developing a detailed work plan for moving forward, and conducting a similar assessment of analysis tools such as IDAS.

### 2.3.3 Standards

#### *2.3.3.1 SAE Travel Information Standards (J2354) Documents*

This Society of Automotive Engineers (SAE) Travel Information Standards (J2354) document describes standardized medium-independent message sets and data elements needed by information service providers for ATIS. The messages contained in this document address all stages of travel (pre-trip and in route), all types of travelers (drivers, passengers), all categories of information (advisory, route guidance, traveler services, etc.), and all platforms for delivery of information (in vehicle, portable devices, kiosks, etc.). The development of these standards provides a basis for interoperability of ATIS devices now and in the future.

#### *2.3.3.2 IEEE Incident Management Working Group Documents*

The Institute of Electrical and Electronics Engineers (IEEE) Incident Management Working Group is a group of transportation professionals, public safety professionals, and hazardous materials experts formed by IEEE to use their expertise in developing the IEEE 1512 Family of Standards. IEEE 1488, IEEE 1489, and ITS Standards were considered during development of the 1512 Standards.

The primary goal of the IEEE 1512 Family of Standards is to facilitate the exchange of messages among transportation management centers and public safety agencies for coordinating traffic incident management. The IEEE 1512 Family of Standards includes:

- IEEE Std 1512-2000, Common Incident Management Message Sets for Use by Emergency Management Centers
- IEEE Std 1512.1-2003, Traffic Incident Management Message Sets for Use by Emergency Management Centers

- IEEE Std 1512.2-2004, Public Safety Incident Management Message Sets for Use by Emergency Management Centers
- IEEE Std 1512.3-2002, Hazardous Material (HAZMAT) Incident Management Message Sets for Use by Emergency Management Centers
- IEEE Std 1512a-2002, Emergency Management Data Dictionary

The IEEE Std 1512-2000 is the Base Standard, which sets requirements for all responding agencies. Companion volumes, IEEE Std 1512.1-2003, 1512.2-2004, 1512.3-2002, and IEEE Std 1512a, work in conjunction with Base Standards and extend content and operating requirements.

These Standards exist above Layer 7 of the Open System Interconnection (OSI) model and together, define specifications for a standardized format of communication which allows existing and/or new systems to easily exchange information with other systems. A description of the basic structure of message sets and how they could be used in a local implementation is included in the IEEE 1512 Family of Standards documents. Entering incident information into systems using common message sets will aid in information sharing and allow agencies to work together more efficiently when responding to incidents.

Users should be aware of possible changes to the standards. Additions and revisions may be made to include new applications and address issues that arise during use.

#### *2.3.3.3 ITE TM 1.03 Standard for Functional Level Traffic Management Data Dictionary (TMDD)*

This standard was developed for ITS systems that manage traffic. It provides a functional level data dictionary consisting of and defining a set of data elements (DE) necessary to support data flows within and among traffic management systems. Specifically, as a data dictionary standard, it provides meta attributes for each DE including definitions (semantics) and specific format (syntax) for individual DEs. The TMDD, as a national functional level data dictionary, provides a standardized national set of DEs that are intended to be the basis of individual application-level data dictionaries implemented at specific sites.

#### *2.3.3.4 ITE TM 2.01 Standard for Message Sets for External Traffic Management Center Communications (MS/ETMCC)*

This standard includes message sets that were developed specifically for ITS traffic management systems. It consists of nineteen message sets organized into six message groups. It was developed under the oversight of a national steering committee composed of representatives of both the Institute of Transportation Engineers (ITE) and American Association of Highway and Transportation Officials (AASHTO) and is being published as a joint standard.

### 2.3.4 Existing Systems

#### *2.3.4.1 Selected Traveler Information Systems*

Major traveler information systems operated by or on behalf of public agencies in urban and rural areas in the I-95 Corridor Coalition geographic region, including the 511 services in Virginia, North Carolina, Florida, and Massachusetts.

##### *The New England Trio System*

The New England Tri-State Rural Advanced Traveler Information System, referred to as Traveler Information Online (TRIO), links existing database systems maintained by Maine, Vermont, and New Hampshire. The TRIO project includes ten modules implemented in three phases over a six-year timeframe. Key participants of the steering team include the departments or agencies of Transportation and Tourism from the three participating states.

When complete, the "TRIO system will provide travelers and tourists with accurate and real-time information of road conditions, lodging, and recreational activities."[5] Travelers and tourists will be able to make informed decisions about their travel patterns using the 511 system, the Internet, highway advisory radio (HAR), and dynamic message signs (DMS).

##### *The New York CARS Information Exchange Network (IEN)*

The Condition Acquisition and Reporting System (CARS) has been deployed over the last five years by ten states, including Minnesota, Iowa, Missouri, Alaska, Washington, New Mexico, Kentucky, and Coalition members, Maine, New Hampshire, and Vermont. The New York IEN is in the process of adapting CARS as the statewide source of information on highway conditions with linkage to computer-aided dispatch (CAD) systems and traffic management systems on an expanding basis.

New York CARS will acquire information from existing systems throughout the state, including: traffic cameras, speed map from the Albany/Capital region, and New York State DOT Winter Traveler Advisory System, with plans to expand to similar systems throughout the state. Authorized staff will input construction, accident, delay, other roadway conditions, weather, and transit information into a statewide event database using the World Wide Web. Information will be available to the public through 511 phone systems, the New York 511 website, and low power FM radio.

##### *The iFlorida Condition Reporting System*

The iFlorida Condition Reporting System (CRS) is Florida's implementation of CARS. The purpose of this project is to develop and implement a road reporting system that supports a multi-state database of traffic events, including: construction, accidents, road conditions, and delays. The iFlorida CRS

[5] I-95 Corridor Coalition, Reports and Projects, *Project Code: 7a-2A, 8a-2A, 9a-2A, & 10-2A Rural Advanced Traveler Information System (RATIS) Tri-State TRIO.* <http://www.i95coalition.org>.

deployment will expand and integrate existing data collection and monitoring systems, collect and share data between agencies, use collected data to improve transportation system management, and distribute data to motorists. Authorized staff will use the internet to input traffic information and travel conditions. Since extreme weather is a major concern in Florida, the CRS will also disseminate weather information.

The iFlorida CRS will be composed of various different modules that will each create independent pieces of software that will plug and play using national ITS standards as center-to-center interfaces between each module. These modules include DMS and Closed Circuit Television (CCTV) software, 511 system, and 511 website. The use of national standards, providing plug-and-play interoperability with other systems, will allow for expansion and provide for interaction with other software programs.

### *Palm Beach County Florida - Interim Traffic Management System*

The Palm Beach County Interim Traffic Management System (ITMS) is a comprehensive traffic and incident management system designed to address impacts of the I-95 construction in Palm Beach County. The ITMS website provides: static images from traffic cameras throughout the county, a list of incident reports, an incident detection map displaying the flow of traffic along I-95, and the option to view current DMS displays.

### *Tampa Bay 511*

In September 2004, Tampa Bay area travelers began using 511 phone and web services to obtain real-time traffic information. Travelers access information by phone or on the web 24 hours a day, 7 days a week (24/7) for specific routes and roadway segments, including: traffic accidents, roadway blockages, lane closures, and anticipated travel delays.

The Tampa Bay 511 system features voice-activated technology, which allows drivers to keep their eyes on the road while interacting with the system. The website displays traffic information in map or text format, issues e-mail alerts, displays incident information for public transportation, and provides motion images from traffic cameras. Road sensors use solar powered, wireless sensors to gather data on speeds, lane occupancy, and vehicle counts. This data is used to calculate travel times which are updated every 60 seconds.

### *South Florida 511*

The South Florida 511 system provides real-time traffic related information for in route and pre-trip planning purposes. Information can be obtained by phone or via the Internet.

The website allows users to create a route by entering a starting and ending point and defining what traffic incidents they want to view. After submitting data, the system maps out the route and includes any traffic problems that may affect travel along the selected route. Users can also view static images from traffic cameras in Palm Beach, Broward, and Miami-Dade counties.

Users can sign up to receive personal alerts and/or be a "Road Reporter". As a Road Reporter, drivers report traffic information to the SmarTraveler®/Sunguide Operations Center. When users sign up to receive e-mail alerts, they can enter up to eight frequently visited locations, eight trips, and eight alert types. When conditions meet the criteria entered, an e-mail notification is sent to the users e-mail address.

### *Virginia 511*

The Virginia 511 website provides travel and service information to the general public. Website users can view images from traffic cameras and obtain travel information including traffic incidents, road work, road conditions, and public transportation. Service listings available on the website include food, shopping, lodging, entertainment, events, weather, trip mappings, and a list of links to other areas of interest.

### *North Carolina Traveler Information Systems*

North Carolina travel information is currently disseminated to the public using the Highway Advisory Radio, Dynamic Message Signs, North Carolina 511, and the North Carolina Smartlink website.

The North Carolina SmartLink website allows users to view all incidents statewide or by selecting a region. Users can view static camera images from cameras located across the state. The Smartlink website provides information about Real-Time Travel, High Occupancy Vehicle (HOV), Traffic Incident Management, ITS Strategic Deployment, and ITS education. The link to Real-Time Travel Information directs users to the North Carolina DOT Traveler Information Management System (TIMS) website.

Information about road conditions can be obtained from the North Carolina TIMS website. Information can be viewed in map or text form. The TIMS website links users to maps, tourist information, ferry and train information, travel information for other states, construction information, emergency information, and the Smartlink website.

### *Northern New England 511*

The Northern New England states of Maine, New Hampshire, and Vermont publish 511 traveler information to their respective DOT's website. Information available on the Northern New England 511 websites includes: accidents and warnings, current driving conditions, construction and maintenance activities, current weather forecasts, National Weather Service watches and warnings, and commercial vehicle restrictions. From any of the three websites, the public can view published information for all three states or a selected region in map or text format. Travelers accessing the Maine DOT website can view static images from cameras located throughout the state.

### *Delaware Department of Transportation Travel Advisory*

The Delaware DOT Travel Advisory website delivers Real-Time Travel Information to motorists from their website. The public can view images from

live traffic cameras, listen to Traveler Advisory Radio System (TARS) broadcasts, acquire a list of scheduled travel restrictions throughout the state, access a list of weight and/or height restrictions for bridges and overpasses, sign up to receive Real-Time Travel Advisories and Scheduled Travel Restrictions by e-mail, and view reports about current traffic conditions.

### *Massachusetts Turnpike Authority*

The Massachusetts Turnpike Authority e-Traveler Program provides a variety of information for local and out of town travelers. Information available on the Travel Services website includes traffic and road conditions, views from traffic cameras, a toll/mileage calculator, maps, weather forecasts, and free e-mail advisories for traffic information, road restrictions, and advisories for the entire Massachusetts Turnpike. The website also includes links to tourist attractions, commercial vehicle operations, and surrounding states transportation agencies.

### *Boston SmarTraveler*

SmarTraveler, a Westwood One Company, is a private company that provides real-time traffic information directly to the public in multiple U.S. cities, including Boston, where it has partnerships with transportation agencies. Westwood One is the leading provider of traffic, news, sports, music, talk, and entertainment programming to Web, wireless, in-vehicle, and broadcast media.

Real-time, route-specific traffic reports for major routes in the Boston area and information about transit conditions and service changes are available to the public via smartraverler.com. The public can view static camera images from cameras located throughout the metropolitan area and sign up to be a SmarTraveler Road Reporter. As a Road Reporter, motorists assist fellow travelers by reporting traffic conditions and incidents.

### *Pennsylvania Traveler Information Systems*

Pennsylvania DOT's (PennDOT) ITS infrastructure is concentrated in Districts 6 (Philadelphia), 8 (Harrisburg), and 11 (Pittsburgh), where traveler information is posted on VMS signs and HAR devices. District 6 also displays video feeds on its website and, through a contract with the Greater Valley Forge TMA, provides information on major construction projects in the region.

The PennDOT website links users to travel information on its website or by redirecting them to SmartTraveler or Traffic.com. Information available on the DOT's website includes:

- A list of bridge closings;
- A map of construction advisories;
- Travel and road maps;
- Information about public transportation; and
- Winter weather road conditions which are displayed on an interactive map.

Real-time traffic information for Philadelphia is available on http://www.smartraveler.com. SmarTraveler, a part of Westwood One, provides information about incidents, road construction, and transit travel conditions.

Traffic.com uses Remote Traffic Microwave Sensors (RTMS) to gather traffic speeds in Pittsburgh and Philadelphia. Travel times, accident and construction information, and transit information can be accessed by phone, Internet, and via personalized messaging. The information is also used in media reports (television and radio).

### *New Jersey Traveler Information System*

New Jersey DOT (NJDOT) disseminates traveler information via variable message signs, HAR devices, its website, and TRANSCOM. Westwood One personnel are stationed in NJDOT Traffic Operations South Transportation Management Center (TMC) to post incident, congestion, and construction information on NJDOT's web page. Live video feeds are also displayed on the web page. TRANSCOM relays incident information in New Jersey to private sector subscribers.

### *Connecticut Department of Transportation*

The Connecticut Department of Transportation provides basic information about traffic incidents and construction and posts images from traffic cameras located in Connecticut. Traffic information, including accidents, road work, and other information, is displayed in text format. General information about public transit, projects, tourism, and other transportation links can also be found on the Connecticut DOT website.

### *Georgia NaviGator*

Users requesting online traffic information from the Georgia Department of Transportation website are redirected to the Georgia NaviGator website. The Georgia NaviGator provides motorists with real-time traffic, incident, and construction information on major interstates and state routes. Users can also access images from traffic cameras, obtain trip times, view current DMS displays, and obtain current weather conditions across the state.

### *Rhode Island*

Rhode Island DOT TMC publishes basic travel information on the Internet for public viewing. Users can view images from live traffic cameras or listen to or read HAR broadcasts from the DOT's website. For information about traffic conditions, users are redirected to http://www.traffic.com where they can view information about current traffic speeds and incidents (including construction) in text or map format.

### *2.3.4.2 Selected Traffic Management Centers*

#### *Florida SunGuide*

SunGuide, South Florida's Intelligent Transportation System, is a cooperative effort of transportation agencies throughout Broward, Miami-Dade, Palm Beach, and Monroe counties. SunGuide is responsible for managing multiple technologies used in South Florida transportation management, including satellite and fiber optic technologies. SunGuide is also responsible for providing motorists with real-time traffic information via DMS, HAR, the Internet, and over the phone.

Several SunGuide TMCs exist in Southern Florida, including: SunGuide ITS TMC in Miami (District 6) and the SMART SunGuide TMC in Fort Lauderdale (District 4). The TMC is a physical location to monitor traffic conditions, respond to incidents, gather data from pavement sensors and cameras, and distribute real-time information to motorist.[6] Operators, dispatchers, law enforcement, and emergency services work together to alleviate rush hour congestion, improve response time, and improve overall traffic flow.

#### *North Carolina Transportation Management Centers*

The North Carolina Department of Transportation operates four TMCs across the state, Metrolina TMC, Western Triad TMC, Eastern Triad TMC, and Triangle TMC. Each TMC provides different services based on available technology. TMC responsibilities include video surveillance, vehicle detection, traffic and incident management, interfacing with HAR and DMS, providing real-time travel information via the Internet, and communicating with emergency agencies and media.

#### *Boston Traffic Management Center*

The Boston Transportation Department operates and maintains a TMC that is housed in City Hall. "The Boston TMC monitors traffic using technologies such as loop detectors and video cameras. The TMC enables real-time traffic monitoring, management, and emergency response coordination. The TMC also monitors images from the Central Artery Tunnel cameras and shares the information with the Massachusetts Turnpike Authority's Operation Control Center."[7]

#### *New York City Transportation Management Centers*

The New York City Police Department (NYPD) TMC and New York City DOT TMC use various technologies, such as video cameras, to manage incidents and

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[6] SunGuide Florida's Intelligent Transportation System, Traffic Management. <http://www.sunguide.org/>.

[7] Boston Transportation Department, Access Boston 2000-2010, *Public Transportation and Regional Connections: Section: 8 Local Arterial Corridors.* <http://www.cityofboston.gov/accessBoston>.

ensure the police department and other city agencies are aware of and responding to traffic incidents when necessary.

The New York State DOT has begun construction on a Regional Traffic Center which is scheduled for completion in 2006. Completion of this project will provide video surveillance, variable message signs, and roadway sensors for the entire New York City limited access highway system and will enhance the ability to detect, report, and respond to incidents.

By visiting the New York City DOT ATIS website, the public can view streaming video or still pictures from cameras located at major locations throughout the city. The website also provides links to other websites that provide cameras at additional locations in New York City.

The public can obtain additional traffic information for a road, region, or customized location on the MetroCommute and TrafficPulse websites. Traffic information available to the public includes accident alerts, delays, special events, construction alerts, lane closures, camera images, roadway speeds, and transit information.

### *Syracuse SmartNET*

SmartNET is the Syracuse Metropolitan Area Regional Transportation Network. SmartNET is a web-based traffic management system which is being developed for New York State DOT Region 3. The system supports operational management and data entry of incidents, construction events, and special events from traffic management centers and other off-site locations. As a web-based application, any authorized user with internet access can view or enter information in the system. Information is available to registered public sector users including traffic operations and maintenance personnel, safety personnel, and local government public works personnel.

Users can view information from a map displaying a list of events and their descriptions. Planned enhancements include the addition of real-time traffic volume and speed data from detectors, road-weather data from sensors, video-sharing capabilities, and a 511 interactive voice response system.

### *New Jersey Turnpike*

The Jew Jersey Turnpike Authority uses an Automatic Traffic Surveillance and Control System to keep traffic moving smoothly and allow personnel in the Traffic Operations Center (TOC) to monitor traffic conditions and make changes to improve traffic flow. Motorists get real-time traffic information, traffic advisories, and weather conditions by listening to current HAR messages or visiting the Jew Jersey Turnpike website. On the website, users can also view current DMS displays, view real-time or still camera images, or read about traffic advisories such as lane closures, expected delays, and heavy volume areas.

### *New Jersey DOT Traffic Operations Centers*

NJDOT operates two traffic operation centers, one for the northern part of the state and one for the southern counties. The centers, which operate 24/7, are

responsible for managing the expressway and state highway systems. CCTV, VMS, and HAR devices are deployed on both systems to monitor traffic conditions and impart traveler information to motorists. The centers also manage the department's highway signal systems. MAGIC provides an integrated Advanced Traffic Management System (ATMS)/ATIS system in the I-80 corridor in New Jersey. Emergency service patrols operate out of both centers, offering motorist assistance on expressways. For more major incidents, NJDOT employs Incident Management Response Teams to coordinate the department's response and provide traffic protection at the incident scene. New Jersey State troopers are assigned to each TMC to assist NJDOT personnel in coordinating incident response. Westwood One has personnel stationed in Traffic Operations South to input traveler information into NJDOT's web page

### *Pennsylvania DOT District 6 Traffic Control Center*

The PennDOT District 6 Traffic Control Center (TCC), located in Philadelphia, uses CCTV, ramp metering, and DMS to keep traffic flowing throughout five counties in the southeastern portion of Pennsylvania. When incidents occur messages are posted on DMS and information flows to traffic news services such as Westwood One, Mobility Technologies, and ClearChannel. Those agencies in turn provide radio traffic information on the stations with whom they have contracts.

### *Maryland CHART*

The Maryland Statewide Operations Center (SOC) is the "hub" of the Coordinated Highways Action Response Team (CHART), with satellite TOCs throughout the state. The SOC operates 24/7 with TOCs operating during peak traffic periods. CHART gathers information using traffic and pavement detectors, CCTV, #77 cellular call-in system, and reports from field units including state and local law enforcement. Information gathered includes road speeds, traffic events such as incidents; congestion, and closures. The Maryland CHART website provides traffic information and emergency road conditions across the state. The public can view the information in text version or by using interactive maps. In addition to traffic and emergency information, CHART provides information about local weather and its impact on travel conditions.

### *Delaware DelTrac*

DelTrac manages real-time traffic information for travel conditions, incidents, congestion, construction, travel times, transit schedules, weather, and events. The public can access this information by viewing streaming video, listening to live broadcasts from TARS, viewing text reports of current traffic conditions, travel restrictions, and bridge restrictions, and signing up to receive real-time travel advisories and scheduled travel restrictions via e-mail. In addition to providing information to the public, DelTrac interfaces with police and fire dispatch and in turn provides police and fire personnel with information on the status of the transportation system.

### *Virginia Smart Traffic Center in Arlington*

The Northern Virginia Smart Traffic Center located in Arlington, oversees more than 100 miles of roadway 24 hours a day, seven days a week. Operators use cameras, DMS, HOV lanes, ramp meters, traffic sensors, lane control signals, and vehicle classification stations to perform congestion alleviation, incident management, and traffic planning activities. The Smart Traffic Center communicates traffic conditions to the public through DMS, HAR, the Highway Helpline, and the road conditions map on the Virginia Department of Transportation (VDOT) website.

### *Virginia Smart Traffic Center in Richmond*

The Smart Traffic Center serving the Richmond District also operates 24/7. The Center works with VDOT, state police, the Transportation Emergency Operations Center, and the media to keep VDOT and the public informed of traffic incidents as they happen. The center uses radio, the Internet, and DMS to provide real-time information to motorists within the fourteen counties and four cities of the Richmond District. On VDOT's website, the public can find information about statewide road conditions, lane closures, traffic volumes, online transportation information map, general highway information, and traveler services such as a link to 511 Virginia.

### *Georgia NAVIGATOR*

Georgia's Transportation Management Center is the headquarters and information clearinghouse for the Georgia NAVIGATOR. Operating 24 hours a day, 365 days a year, the TMC collects real-time traffic information from monitoring and Video Detection System (VDS) cameras, CCTV, ramp meters, and calls from motorists. TMC employees confirm and analyze every incident and contact the appropriate authorities, such as police, fire, or Highway Emergency Response Operators (HERO), so they can respond to the incident. Real-time traffic information, still camera images, DMS displays, travel times, and weather information are available to travelers through the NAVIGATOR website, media sources, or by calling the TMC customer service center.

## 2.3.5 Proposed Systems

### *2.3.5.1 Regional Integrated Multi-Modal Information Sharing (RIMIS)*

The purpose of the RIMIS project is to develop an information sharing system that will link transportation agencies, emergency management agencies, information service providers, and other selected agencies in the greater Delaware Valley area. The primary emphasis of the RIMIS project is to implement a software platform that can be placed on computers in various operations centers. To improve current procedures for information sharing among agencies, a decentralized approach using a message based information exchange network has been selected as most appropriate.

In the future, emerging technology may allow for the development of a portable RIMIS platform that may be taken into the field. The long-term vision of RIMIS

is to establish a virtual database that will store incident information, traffic speeds, traffic volumes, transit schedules, and other real-time information through field detectors.[8]

The RIMIS Concept of Operations is currently in the development stages. Development of high level functional requirements and an implementation plan will begin following the technical committee's review of the Concept of Operations.

#### *2.3.5.2 Capital Wireless Integrated Network (CapWIN)*

The Capital Wireless Integrated Network (CapWIN) project began as a partnership between Maryland, Virginia, and the District of Columbia to develop an integrated transportation and criminal justice information wireless network. The project is being completed in multiple phases. Strategic planning and implementation have been completed; development and expansion are continuous phases of the project.

The Strategic Plan was developed based on input from transportation and public safety agencies (federal, state, and local) serving the Washington Metropolitan area. "Development and implementation of the initial CapWIN infrastructure including a mobile data system with message switching functions and a message gateway function to connect disparate systems included all work associated with the provision of an operational system with the following components:

- Message Switching Function
- Message Gateway Function
- Client software
- Security infrastructure
- Audit systems
- Installation and Integration
- Necessary peripherals software/hardware
- Migration of CapWIN Pilot Project Mobile Computers"[9]

The system is currently in full production and being used by police and fire agencies and more recently by transportation personnel across Washington D.C., Maryland, and Virginia to communicate operations related information. Access to CapWIN is now occurring through existing and newly deployed Mobile Data Computers (MDC's) and Personal Digital Assistants (PDS's). CapWIN system can also be accessed from desktops via direct WAN/LAN access.

Ongoing efforts include the addition of priority functionality, expansion of interfaces, system operations, and maintenance. Potential functionality and interfaces to be added may include: interfaces to medical databases, Automatic

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[8] Delaware Valley Regional Planning Commission, *Request for Qualifications for Regional Integrated Multi-Modal Information Sharing System (RIMUS).* 2004.

[9]Capital Wireless Integrated Network, *Strategic Plan 2001 - Updated for 2002-2003*. November 15, 2002

Vehicle Location (AVL), and interfaces to additional existing mobile data systems.

#### *2.3.5.3 CapCOM*

CapCOM represents a cooperative effort of the Washington Metropolitian Region's transportation agencies with the support of the Greater Washington Board of Trade. CapCOM is a targeted activity whose scope is devoted to overseeing the planning and communications functions associated with transportation operations in connection with the region's response to major incidents, such as, but not limited to, terrorist incidents. CapCOM's information sharing functions include communications among agencies as well as with the media and general public to ensure that there is a uniform understanding of the state of the transportation system during such incidents

CapCOM represents an entity that will facilitate operational coordination and collaboration among transportation agencies and implement a permanent "Center" that will improve the management and sharing of incident-related transportation systems condition and impact information. The goals of CapCOM are to:

- Provide better real-time transportation information to emergency, managers, the public safety community, and decision-makers in support of their roles in responding to major regional incidents.
- Help improve the availability and accuracy of real-time transportation information in support of entities that will provide information to the public in such situations, such as emergency managers, transportation agencies, and the media.
- Facilitate coordination among regional transportation decision-makers while an incident is in progress.
- Support post-incident evaluation of response activities and to provide needed support for exercises and training.

#### *2.3.5.4 Regional Integrated Transportation Information System (RITIS)*

The Regional Integrated Transportation Information System (RITIS), which will be hosted by the CapCOM Center, emphasizes data fusion and its relationship to data collection, regional transportation systems management, regional traveler information dissemination, and systems evaluation. Figure 2 illustrates the relationship between RITIS and other regional functions. RITIS takes data of regional interest and fuses that data into regional information that can be used to enhance regional traveler information and transportation management functions performed by member agencies. RITIS enhances on-going activities performed by individual agencies providing each agency with regional information.

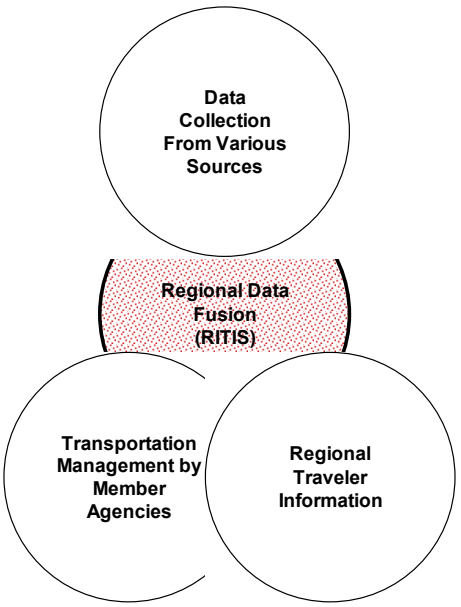


**Figure 2 - Relationship Between Regional Functions**

The RITIS project advances regional data fusion and how real-time regional information can be used to support transportation management, traveler information, emergency preparedness, emergency response, and other regional priorities. The project is a pilot intended to demonstrate that the technical elements can be developed in a cost effective manner and provide significant benefit to the region. The project directly supports the Metropolitan Washington Region's on-going and planned ITS activities (e.g., 511, CapCOM, CapWIN) and incubates the basic technical components that the region needs in order to improve transportation efficiency, safety, and security.

## *2.4 Modes of Operation*

A *mode of operation* defines a set of operating rules and constraints associated with a particular set of system conditions. For the transportation system, the modes may be informally defined in an agency's Incident Management Plan(s) or Disaster Management Plans. Since the definitions may vary among agencies, generalized modes of operation considered in this document are:

- Normal (based on continuity of traffic operations: includes anticipated events such as incidents/accidents, planned work zones, and normal weather),
- Abnormal (based on closure of a direction of travel on a roadway),
- Emergency (may not involve a closure, but significantly modifies traffic controls, including transfer of controls to other agencies), and
- Disaster (an emergency involving sustained damage to system infrastructure).

## *2.5 User Classes and Other Involved Personnel*

This section describes the potential users of the ISN. While each coalition member agency has its own organizational structure and unique functional

responsibilities, similar functions and classes of users are present across all agencies.

Information must be presented to all users in "real-time", meaning that the information is only valuable if it can be provided and acted upon quickly enough to reduce the impact of the event as it is occurring. The information also needs to be accurate, at least to the extent that it would not lead to actions that might make events worse.

### 2.5.1 Operators

Operators include several local, regional, and state transportation agencies that exist within the I-95 corridor. Operators monitor roadways and/or transit services for various reasons, which are determined by their role in maintaining normal travel conditions. Regardless of their reason for monitoring roadways and/or transit services, operators have one common objective, to minimize the impact of incidents and events on the normal flow of traffic.

As part of monitoring roadways, operators perform common functions and require similar information in order to effectively manage traffic information.

Common functions among operators include:

- Reviewing major travel impacting incidents and events occurring outside their area;
- Assessing potential impact on travelers;
- Determining if response actions are required; and
- Monitoring the incident or event for updates and/or cancellations.

Common information needed by operators includes:

- Location (including state, route, distance from state line, direction of travel impacted, etc.);
- Incident or event type (incident, work zone, road weather condition, special event, AMBER Alert, etc.);
- Impact (closures, delays, etc.);
- Extent of impact (priority rating);
- Start time (of planned and emergency incidents);
- Duration estimates; and
- Weather service alerts;

#### *2.5.1.1 Transportation Management Centers*

Transportation Management Centers monitor roadways, analyze the observed conditions, implement control strategies, publish advisory information, and initiate incident remediation. Active and planned work zone activities, major incidents, road conditions, and planned special events can be monitored, analyzed and managed by various means through a TMC.

TMCs may use this information to manually confirm the incident or event impact and manually issue appropriate information to their travelers or take other traffic management actions. For example, a major incident several states away may result in alternate route recommendations within the TMCs coverage area. This

would require appropriate alternate route messages to be posted on DMS and HAR within the TMCs jurisdiction.

Additional TMC functions relating to use of traffic data include:

- Selecting message dissemination means and locations (DMS, HAR, or other traveler information services) and other traffic management strategies required to respond to and inform others of incidents and events (such as notifying broadcast media);
- Developing/selecting message to be broadcast to DMS, HAR and other traveler information services; and
- Disseminating message recommendations and implementing other traffic management strategies.

#### *2.5.1.2 Motorist Assist and Service Patrols*

There are several local and regional motorist assist/service patrols operating within the I-95 corridor. Motorist Assist/Service Patrols reduce roadway congestion by analyzing and reacting to changing conditions on the roadway. Information concerning lane closures, incident information, and roadway conditions are often relayed back to the TMC for assistance in managing traffic. This is especially helpful in areas where roadway detection devices are not available. Contracted personnel may have less flexibility and authority to make operational decisions than those that are attached directly to the state or local agency.

#### *2.5.1.3 511 System Operations*

Multiple 511 Traveler Information Systems exist within the I-95 corridor. 511 systems collect and share information concerning the transportation system and the effects that changing conditions have on that system. This information can be used by long and short distance travelers to plan their trip. Information collected from various sources and distributed to travelers through the 511 system includes:

- Active and planned work zone activities (lane closures);
- Major incidents and their expected duration;
- Weather and road conditions (icy or snow covered roads); and
- Planned special events.

511 Traveler Information Systems manually or automatically update their traveler information content. This information can also include floodgate messages concerning severe travel restrictions or AMBER (America's Missing Broadcast Emergency Response) Alerts. Some 511 systems also act as data sources for their companion 511 web sites.

#### *2.5.1.4 Transit Operators*

Transit operators are responsible for ensuring transit operations achieve optimal performance. Transit operators continuously monitor transit schedules and travel conditions for planned events, current road conditions, and incidents along existing routes in order to identify potential problems. When transit operators identify a problem, drivers are notified and alternate route recommendations are

made. Operators notify drivers when incidents have been cleared from normal routes.

#### *2.5.1.5 Commercial Freight Dispatchers*

Commercial freight dispatchers working for local and long distance freight companies coordinate the movement of trucks and freight between cities. Primary responsibilities of commercial freight dispatchers include coordinating pick-up and delivery activities, assigning drivers and trucks, and specifying pick up and delivery routes. Dispatchers ensure timely and efficient movement of freight by handling all problems that disrupt service, such as dispatching service trucks for repair.

#### *2.5.1.6 Traveler Information Services*

Traveler information services provide a variety of information to motorists via the Internet or by phone. Information available to motorists through traveler information services includes real-time or static information. Real-time information includes current road conditions such as congestion, construction, weather-related road conditions, travel time to a destination, transit departure and arrival times, and the availability of spaces in parking lots. Static information is known in advance and changes less frequently, such as planned construction, special events, transit schedules and fares, maps, and commercial vehicle regulations.

### 2.5.2 Travelers

Travelers include drivers and riders of private, commercial, or transit modes of transportation. Travelers obtain travel information from various sources and, in turn, use that information to prepare for a daily commute or to map a route for an extended trip.

Common functions among travelers relating to the use of traffic data include:

- Reviewing traveler information services for possible delays along desired route(s); and
- Choosing an alternative route or mode of transportation.

Common information needed by travelers includes:

- Location (including state, route, distance from state line, direction of travel impacted, etc.);
- Incident or event type (incident, work zone, road weather condition, special event, AMBER Alert, etc.);
- Impact (closures, delays, etc.);
- Start time of planned events;
- Duration estimates;
- Weather service alerts; and
- AMBER Alerts.

#### *2.5.2.1 Private Vehicle Drivers*

Private vehicle drivers consist primarily of the general public, commuting to and from work, traveling through the area, running errands, etc. Private vehicle drivers receive traffic information from AM/FM radio and various traveler information systems, such as 511, DMS, HAR, and the Internet.

#### *2.5.2.2 Commercial Transit Riders*

Commercial transit riders travel via bus, rail, or other means of transit transportation. Commercial transit riders may obtain transit schedules, delays, fares, and other information on the Internet or by calling the desired transit agency.

#### *2.5.2.3 Commercial Transit Drivers*

Commercial transit drivers transport customers via community transit services (bus, rail, cab, etc.) in assigned areas, while observing traffic and safety rules, and adhering to time schedules. In addition to transporting customers, commercial transit drivers provide information to customers in multiple ways, such as by answering questions In route, making general announcements, issuing transfers, and collecting fares.

Commercial transit drivers receive information about road conditions, construction, delays, etc. from transit operators via company radio or similar means.

#### *2.5.2.4 Public Transit Riders*

Public transit riders travel via bus, rail, or other means of transit transportation. Public transit riders may obtain transit schedules, delays, fares, and other information on the Internet or by calling the desired transit agency.

#### *2.5.2.5 Public Transit Drivers*

Public transit drivers also transport customers via community transit services (bus, rail, etc.) in assigned areas, while observing traffic and safety rules, and adhering to time schedules. In addition to transporting customers, public transit drivers provide information to customers in multiple ways, such as by answering questions In route, making general announcements, issuing transfers, and collecting fares.

Public transit drivers receive information about road conditions, construction, delays, etc. from transit operators via company radio or similar means.

#### *2.5.2.6 Commercial Freight Drivers*

Commercial freight drivers may be transporting goods over long or short distances. Commercial freight drivers may obtain traffic information using the same means as private vehicle drivers (AM/FM radio, 511, DMS, HAR, etc.) or by radio from dispatch operators or other commercial freight drivers.

### 2.5.3 Emergency Responders

Emergency responders are trained personnel who assist in controlling and/or reducing human loss and suffering that may result from emergency incidents or major disasters that can occur on or off the roadway system. Their primary goal is to protect themselves and the general public during the initial response phase of the incident. There are a number of emergency response agencies within the I-95 corridor. Emergency responders include fire and police departments, emergency medical services, public health agencies, and other emergency rescue agencies. The strength of emergency responder's general capabilities has a significant impact on the level of emergency preparedness within their given jurisdiction.

Common functions among emergency responders include:

- Review major travel impacting events for emergency incidents occurring on the transportation system;
- Assess roadway conditions for response and/or evacuation route selection;
- Disclose immediate hazards, risks, and precautions to be taken;
- Monitor the event in relation to emergency/disaster transportation needs; and
- Update or end response actions.

Common information needed by emergency responders includes:

- Location (including state, route, distance from state line, direction of travel impacted, etc.);
- Incident or event type (incident, work zone, road weather condition, special event, AMBER Alert, etc.);
- Impact (closures, delay, etc.);
- Extent of impact (priority rating); and
- Number of injuries/exposures, if known.

#### *2.5.3.1 Law Enforcement Agencies*

Law enforcement agencies (LEA), including local police, sheriffs, highway patrol and state police, serve the public through patrol and investigative services. In addition, these agencies may have special units such as crime prevention, special weapons, and tactics teams. All units of a law enforcement agency work together within their agency to protect the lives and property of the public they serve, with dignity and respect. As first responders, law enforcement officers may recommend actions to be taken, rescue people in danger, provide emergency medical services, and handle situations involving hazardous materials.

Additional information needed by LEAs:

- Start time of planned events; and
- Duration estimates.

#### *2.5.3.2 Emergency Management Agencies*

Emergency Management Agencies (EMA) coordinate multiple emergency management efforts in response to data provided by multiple organizations, such

as roadway information. EMA use roadway information to assist in planning emergency response routes as well as selecting from predetermined evacuation route alternatives.

Emergency Management Agencies utilize transportation system information to manage responses to major emergencies/disasters. Transportation system information is also utilized for evacuation route planning when major disasters such as hurricanes or flooding occur.

Additional information needed by EMA includes:

- Time of incident;
- Estimated length of time for clean-up;
- Current weather conditions and advisories at the scene; and
- Contact number.

#### *2.5.3.3 Emergency Medical Personnel*

Emergency medical personnel are called to a scene to provide immediate medical attention to injured persons. Emergency medical personnel take vital statistics to determine a person's medical condition, and recommend continued treatment by hospital emergency personnel, if needed.

#### *2.5.3.4 Fire Departments*

Fire departments are the first line of defense in many dangerous situations. Fire departments arrive at the scene within minutes of receiving an alarm, often before anyone knows what is being reported, a fire, a crash, or an act of terrorism. In addition to fighting fires, fire departments rescue people in danger, provide emergency medical services, and handle situations involving hazardous materials.

#### *2.5.3.5 Hazardous Material Management (HAZMAT)*

Hazardous materials may potentially cause harm to humans, animals, or the environment either by itself or through interaction with other factors. HAZMAT professionals manage and/or advise others in all stages of material management from planning and development; through manufacture, distribution and use; to disposal, cleanup and remediation.

Additional information needed by HAZMAT personnel:

- Name of reporting agency;
- Time of incident;
- Material involved (if known) and description of containers/packages;
- Size/amount of release;
- Current weather conditions at the scene;
- Contact number; and
- Actions taken.

After assessing a situation, HAZMAT personnel provide an estimated length of time for clean-up.

#### *2.5.3.6 Department of Transportation Emergency Responders*

Each state's DOT is responsible for developing its own emergency response plan. DOT emergency responders primarily include maintenance staff, but may include staff from other areas, if needed. DOT emergency responders provide equipment, materials, and labor for emergency response (such as debris removal, damage repair, and traffic control.)

Additional functions of DOT emergency responders relating to the use of traffic data include:

- Taking necessary precautions required to maintain the safety of emergency responders and the general public.

Additional information needed by DOT emergency responders:

- Immediate hazards, risks, and precautions to be taken;
- Recommended detours; and
- Estimated length of time for clean-up.

#### *2.5.3.7 Homeland Security*

The mission of the United States Department of Homeland Security is to "prevent and deter terrorist attacks, protect against and respond to threats and hazards to the nation, ensure safe and secure borders, welcome lawful immigrants and visitors, and promote the free-flow of commerce."[10] In order to successfully carry out its mission, the department must be able to identify, understand, and react to potentially dangerous situations and disseminate information to homeland security partners and the American public in a timely manner. The Department of Homeland Security characterizes the threat of emergency incidents and further investigates incidents for terrorist activities.

Additional information needed by Homeland Security:

- Name of reporting agency;
- Time of incident;
- Material involved (if known) and description of containers/packages;
- Size/amount of release;
- Immediate hazards, risks, and precautions to be taken;
- Recommended detours;
- Estimated length of time for clean-up;
- Current weather conditions at the scene;
- Contact number; and
- Actions taken.

### 2.5.4 Maintainers

Maintainers are responsible for restoring an incident scene to normal operation and reopening the roadway to traffic. This may include cleanup of non-hazardous

[10] U.S. Department of Homeland Security, *Securing Our Homeland - U.S. Department of Homeland Security Strategic Plan.* 2004.

materials and repair of damaged materials. After the roadway has been reopened, maintainers assess the incident scene to determine if additional repair is required and schedule the work to be done.

Common functions of maintainers relating to the use of traffic data include:

- Reviewing major travel impacting incidents and events occurring outside their area;
- Assessing potential impact on travelers;
- Determining if response actions are required;
- Performing clean-up and repair; and
- Monitoring the event.

Common information needed by maintainers includes:

- Location (including state, route, distance from state line, direction of travel impacted, etc.);
- Incident or event type (incident, work zone, road weather condition, special event, AMBER Alert, etc.);
- Impact (closures, delay, etc.);
- Recommended detours;
- Start time;
- Duration estimates; and
- Weather service alerts.

#### *2.5.4.1 Maintenance Management*

Maintenance management evaluates incidents and determines which maintenance agencies are needed to restore normal operations in the most efficient manner. Maintenance management dispatch roadway maintenance workers, ITS maintenance workers, and other agencies if needed.

#### *2.5.4.2 Roadway Maintenance Workers*

In addition to maintaining road conditions on a day to day basis, roadway maintenance workers are responsible for clean-up, preparation, and repair of damaged roadways. Roadway maintenance workers are dispatched to the scene of an incident to perform maintenance functions.

#### *2.5.4.3 ITS Maintenance Workers*

Intelligent Transportation Systems provide a variety of important benefits to the traveling public, including DMS and 511 services. ITS Maintenance Workers are responsible for ensuring that ITS are maintained in order to ensure efficient ITS operations. This includes repairing, maintaining, or replacing equipment damaged or destroyed as a result of an emergency situation.

#### *2.5.4.4 Law Enforcement Agencies*

The goals of law enforcement agencies with respect to transportation are to ensure public safety as motorists travel along America's roadways and to manage traffic and emergency incidents. As maintainers, law enforcement personnel may

redirect traffic to alternate routes, remove foreign objects from roadways, or take other actions necessary to maintain or restore normal operating conditions.

#### *2.5.4.5 Towing*

Towing companies provide towing, recovery, and roadside assistance in emergency situations. Towing companies may offer additional services such as heavy equipment hauling, auto repair, locksmith services, cab services, etc.

#### *2.5.4.6 Motorist Assist and Service Patrols*

Motorist Assist/Service Patrols aid in maintaining normal roadway operations by monitoring roadways, responding to incidents, and providing basic assistance to travelers often in the form of changing tires, providing fuel, or moving stalled vehicles. Service patrols report and receive information about incidents and delays from TMCs.

#### *2.5.4.7 Construction Personnel*

Construction personnel repair damage to roadways and bridges caused by emergency incidents or resulting from normal traffic conditions. Construction personnel are called to a scene immediately when extensive damaged has occurred that cannot be repaired by roadway maintenance workers. Construction personnel may also be called upon to complete additional repairs after the incident scene has been cleared and reopened to travelers.

### 2.5.5 Regional Event Reporting Systems

Several event reporting systems exist along the I-95 corridor. These systems are often standards-based condition reporting systems that allow authorized users to enter, view, and disseminate critical road, travel, weather, and traffic information through a GUI interface. These systems can cover multiple states, single states, or mixed jurisdiction regions. They are typically operated by the State departments of transportation, although some regional consortiums are active in this area.

Some of the existing regional event reporting systems have already been discussed in Section 2.3. In that context, these systems provide many of the same functions and features on a regional basis that are provided by a TMC and its field infrastructure. The regional systems in many cases, however, also obtain and redistribute information from various TMCs within that region. In that sense, the regional systems are users of the other systems.

The data housed in a statewide event reporting system can be generated by automated or manual methods. Manual data entry into the system and data management is often accomplished through web based user interface.

Event reporting systems can serve as a collection point for real-time transportation system information from various stakeholders including the state police, motorist assist, metropolitan planning organizations, and local maintenance and construction crews. Event reporting systems can also capture planned events.

Event reporting systems typically provide the following features on a broad geographic basis:

- Ability to enter and update event information;
- Ability to record planned events ;
- Serve as information source for traveler information systems;
- Serve as a means of communicating and displaying event information with the covered region; and
- Serve as an information source for other systems.

Event reporting systems typically capture and distribute a wide variety of transportation data. The level of data collected and distributed is often dependent on the level of maturity of the event reporting system. Systems which were initially design for manual event entry are being expanded to handle real-time data from other sensor systems and generate corresponding events. Typical data available from a statewide event reporting system includes:

- Construction and maintenance work zones
- Road closures
- Lane closures
- Travel restrictions
- Special/planned events
- Congestion
- Delays
- Hazards
- Contact details
- Travel speeds
- Roadway conditions
- Weather conditions

# 3 JUSTIFICATION FOR AND NATURE OF CHANGES

This section relates the situation or current state of the system to its operational objectives so as to describe the motivation for development of a new system or modification of the existing system. It therefore provides a transition from the description of the current state in Section 2 to the description of the desired future state in Section 4.

## *3.1 Justification for Changes*

The transportation management and traveler information systems deployed throughout the I-95 corridor have significantly improved access to real-time information within the reach of each of those systems. Travelers within a particular region or metropolitan area with a TMC or 511 system have reasonable access to reliable traveler information.

Travelers in general, however, do not know anything about or respect the boundaries of the systems and regions. Through travelers may not be aware of the transition from one region to the next, and might be surprised when encountering an event *not* described in their 511 call fifteen minutes earlier. Likewise, the daily flow of traffic at any point in the corridor is driven by events "somewhere in the system" more than by the monitoring and control provided by a particular TMC.

There are, therefore, substantial potential benefits to be realized in sharing event information between jurisdictions and systems along the corridor. These benefits will vary among the transportation stakeholders according to the specific scenario. Information about a single-vehicle crash on a secondary road is probably of interest only to that driver and local law enforcement, but it becomes a wider concern if it is a tanker truck with hazardous material at an underpass.

Instead of trying to build a case for change based on specific events, the objectives for improving the situation can be derived directly from the common over-arching goals of improving safety, mobility, and customer satisfaction while controlling costs.

The overall safety of the transportation system is a complex function of many factors, including design and operation of both infrastructure and vehicles. As related specifically to system operations, safety objectives are to:

- Be informed of risks (e.g., hazardous materials, weather, terror) so that they can be monitored appropriately;
- Improve timeliness and accuracy in monitoring risks;
- Reduce operating risks to travelers, operators, and maintenance personnel (e.g., work zones, secondary collisions); and
- Communicate risks to travelers, operators, and maintenance personnel.

Mobility along the corridor and throughout the system has to both plan for and respond to events. Operational objectives contributing enhanced mobility are to:

- Improve operations planning (for example, work zones and special events);
- Actively manage traffic, where those capabilities exist (e.g., access control, ramp metering, reversible lanes);
- Actively assist the flow of traffic (for example, through Safety Patrols / Motorist assist and debris removal);
- Expedite incident response; and
- Provide effective traveler information, as measured by its impact on mobility.

Customer satisfaction is perhaps the most important measure of operations success, but is also difficult to quantify. As a whole, the transportation community seems to have reached consensus that objectives contributing to customer satisfaction are to:

- Provide a seamless, cohesive transportation system (fulfilling driver expectation for consistency of experience, regulation, and information), without regard to jurisdiction;
- Provide consistent travel times;
- Provide timely traveler assistance; and
- Provide timely and accurate traveler information.

Costs of operations are under increasing scrutiny as escalating demand and wear intersect with flattening budgets. Although this is an established issue for pavement and infrastructure, it is also becoming an issue for ITS in some agencies. Holding the line on costs of operations is facilitated by efforts to:

- Minimize new investment;
- Leverage existing investment; and
- Use operations resources effectively.

## *3.2 Description of Desired Changes*

In contrast to the objectives for data sharing described in the previous Section 3.1, the existing transportation management and traveler information systems throughout the I-95 corridor, described in Section 2, share very little information between agencies and systems. Communications about events that cross agency lines occur between operations personnel in the agencies as needed. In the best cases, agencies have established cooperative agreements for information sharing and may have policies and procedures in place for emergency and incident management.

The problem with the existing system of interagency communication is that it depends on human interaction to get information from one set of systems to another. The purpose of the I-95 Corridor Coalition Information Systems Network is to provide the ability to share event information between systems across all transportation agencies operating along the corridor. In an ideal circumstance, the

ISN would allow any agency to see information from anywhere along the corridor as if the information were native to that agency's own systems, without the need for human intervention to get the data from one system to the other.

The rest of this section describes functions and features desired for the ISN. In a sense, these are the "proto-requirements" for the ISN; they describe what the system should be able to do, but do not attempt to explain how that function or feature would be implemented. Subsequent sections prioritize these proto-requirements and describe limitations in these implementation priorities.

### 3.2.1 Operations Information Exchange

The fundamental change to be implemented in the ISN is the ability to exchange event information with other transportation management and traveler information systems. Information exchange includes the ability to:

- Get alerts from other systems;
- Publish alerts to other systems;
- Get information from other systems; and
- Publish information to other systems.

The information to be exchanged potentially includes any parameters available in the system publishing the information or used by the system making the request. Based on the profiles of existing systems in Section 2.3.4, information to be exchanged potentially includes:

- Speed/volume/occupancy
- Lane status/direction
- Incident data
- Weather conditions
- Work zone data
- Transit status
- Transit schedule
- Alternative route
- HAZMAT data
- Video

### 3.2.2 System Administration

Obtaining access to information from other systems is only possible if those systems are known to be potential sources. A registry or directory of services is an essential part of building the ISN and formalizing the relationships between the systems along the corridor. Likewise, it is likely that participating agencies will want to control and monitor access to information by specific individuals and groups of users. Functions needed to administer the registry would include the ability to:

- Register users and services ("principals", in system security language);
- Authenticate users and services; and
- Authorize users and services.

### 3.2.3 Standard Event Message Format

The value in having access to operations data from other systems is seriously compromised if the format is unknown or variable over time. Costs are also increased if a unique interpreter is required for each new system from which information is requested. These risks are mitigated in the ISN by requiring all systems publishing information to implement standard publishing formats for their information. Each system subscribed to that information correspondingly implements a single event-importing component for information published in the standard format.

### 3.2.4 Miscellaneous Features

Some features that might be desirable for the ISN are not necessarily part of the direct interfaces between existing systems.

A network event "browser" would enable a user independent of any existing transportation management or traveler information system to review events across the ISN. This capability would give ISN information access to agencies that might not have such systems in house, or to those needing access while more automated access is still in development. Essentially, any registered user with access to a web browser could view events that had been published to the ISN by other data providers. These users would not be able to publish events to the ISN themselves, and, since they are assumed not to have any relevant existing traffic management or traveler information systems, would not subscribe to specific events as other users would.

Configurable event filters would allow events meeting specific criteria to be published or subscribed. On the publishing side, this would allow an agency to filter out system test events or to protect information that might compromise the security of the system or safety of travelers. Filters could also be used to limit the number of messages and complexity of information presented to transportation management system operators from other systems or agencies.

Since some interested agencies might not have access to automated management systems, it would be advantageous to have a manual means for entering event information to be published on the ISN. With appropriate administrative and security precautions, this could be a powerful means of extending the operational reach of the ISN into jurisdictions with no automated means of acquiring event information.

### 3.2.5 Data Archiving

An archived data management system has long been a desired component of ITS deployments. Few transportation management systems, however, have actually implemented data archiving components, largely because of the cost and complexity of managing the archive. Having already specified a registry and

interface standards for systems publishing data to the ISN, however, implementing a data archiving service common to all those systems is a reasonably straightforward extension to other desired capabilities. The archiving components would also include the ability to search the archived information and to generate reports from the archives.

Data from the ISN could also find its way into other related archives. In particular, ICAT will include provisions for archiving system information along the length of the corridor. Some of the real-time operations data available in the ISN may be used to generate system performance information for the ICAT archives that would be valuable to downstream analysis and planning activities.

### 3.2.6 Data Source

Irrespective of decisions made about the archiving of data, it is desired that the ISN track attributes of the data supplied to the ISN by data providers. It will be important to track the source of the data supplied to the ISN and the point in time at which the data was published to the ISN. This information can be used for the forensic analysis of operational decisions based on the data provided, and potentially for quality audits of the provided data by the I-95 Corridor Coalition.

### 3.2.7 Institutional Policies

Changes needed to establish information sharing between agencies include institutional challenges as well as technical solutions. Although most agencies that would be candidates for participating in the ISN already have policies for dissemination of agency information, the speed and range of distribution provided by the ISN will require at least a review of existing procedures, and probably necessitate some addenda. Participating agencies will also have to establish an administrative body and policies for the ISN itself. At a minimum, policy areas to be considered must:

- Establish an ISN administrative body, policies, and procedures;
- Establish agency policies for publishing and using "external" information; and
- Establish agency policies for verification, validation, and auditing.

### 3.2.8 Training

It is desired that appropriate training opportunities be created as part of the ISN development efforts. These may include training materials, courses, and on-site or remote support capabilities suitable for both system operators and system administrators. Training activities developed for the ISN must recognize the out-of-state travel challenges facing agency personnel.

## *3.3 Priorities Among Changes*

### 3.3.1 Essential Features

Essential features of the system are those that are required for the system to exist and function to the most minimal set of requirements. Table 1 lists those features which are necessary to establish a minimally functional ISN and describes the rationale for including each feature.

**Table 1 - Essential Features of the ISN**

| Feature | Rationale |
|---|---|
| Ability to get essential data from other systems | The base functional need to be addressed by the ISN. Essential data includes:<br>• speed/volume/occupancy<br>• incident data<br>• lane status/direction |
| Ability to publish essential data to other systems | Complementary to preceding feature |
| Ability to get alerts from other systems | Alerts provide a means of monitoring the system by being notified automatically of specific conditions |
| Ability to publish alerts to other systems | Complementary to preceding feature |
| Register users and services | Establishes and defines the extent of the network |
| Authenticate users and services | Assures that messages are to and from legitimate registered users and services |
| Authorize users and services | Aligns users and services with policies governing access and behavior on the ISN |
| Implement standard publishing format(s) | Establishes structure and format of data exchange |
| Provide network event "browser" | Provides human interface to the network registry and data |
| Establish ISN administrative policies and procedures | Establishes policies governing standards, access, and behavior |

### 3.3.2 Desirable Features

Desirable features of the system are those that add value or functionality to the system's capabilities, but are not required for it to operate. Table 2 lists those features which are desirable for expanding the usability and application of the ISN and describes the rationale for including each feature.

**Table 2 - Desirable Features of the ISN**

| Feature | Rationale |
|---|---|
| Ability to get useful (but not necessarily essential) data from other systems | The base functional need to be addressed by the ISN. Desirable data includes:<br>• work zone data<br>• weather conditions<br>• transit status<br>• video |
| Ability to publish useful (but not necessarily essential) data to other systems | Complementary to preceding feature |
| Establish agency policies for publishing and using "external" information | As data exchange becomes more prevalent, agencies will want and need to establish explicit control over the content of that exchange |
| Establish agency policies for verification and validation | As data exchange becomes more prevalent, agencies will need to establish control over the quality of data |

### 3.3.3 Optional Features

Optional features of the system are those that might add value or functionality to the system's capabilities for some subset of scenarios or users. Table 3 lists those optional features to be considered in expanding the usability and application of the ISN and describes the rationale for including each feature.

**Table 3 - Optional Features of the ISN**

| Feature | Rationale |
|---|---|
| Ability to get optional data from other systems | The base functional need to be addressed by the ISN. Optional data includes:<br>• transit schedules<br>• alternative routes<br>• HAZMAT data |
| Ability to publish optional data to other systems | Complementary to preceding feature |
| Implement archiving service | Since all event data is exposed to the ISN, an archiving service would be able to grab and store all operating data, if such a service was useful |
| Implement archive search | An operating data archive needs to be searchable to be useful |

| | |
|---|---|
| Implement archive reporting | Standard reports from an operating data archive might be useful to some agencies |
| Implement configurable event filters | Event filters would provide a means for limiting the amount of undesired data presented to users and systems |

## *3.4 Changes Considered but Not Included*

This section identifies and discusses those system functions and features that were considered for the ISN, but have not been included in the description of the future system.

The implementation of standard event publishing formats for the ISN creates data-sharing opportunities not just for existing systems along the corridor, but also for new systems and stakeholders. One such application would provide a means for direct manual entry of events onto the ISN. Such an application would allow stakeholders without existing transportation management systems to provide data to other stakeholders. While this is certainly possible, it is not recommended, for the following reasons.

- The ISN is fundamentally a means of directing requests for standard information, and not about the information itself. Building a data entry application would make the ISN an alternative to the systems it is supposed to serve.
- If an agency wanted to participate in the ISN, it most likely would already need its own event management system. The ISN (and the I-95 Corridor Coalition) would effectively be subsidizing that agency's development efforts with a generalized interface.
- Manual entry amplifies quality assurance issues. The ISN would need to institute additional verification procedures specific to the manual entry interfaces.
- Most stakeholders will prefer interfaces tailored to their specific needs. Users will want to customize a generalized manual data entry interface. The ISN would eventually be requested to implement a large variety of specialized interfaces, or to provide customization tools for the interface.

Event data available through the ISN may be useful to stakeholders beyond the pool of transportation operations managers and traveler information providers that are the initial focus of the effort. In particular, law enforcement and emergency services personnel operating along the corridor would be able to use much of the event data to be published to the ISN, and are included as a user group in this document. These groups typically, however, would use and depend on CAD systems for acquiring and distributing event data within their own environments. Transportation management and CAD systems have been integrated in some instances, usually where the operations centers are sharing physical space as well.

This ISN concept of operations does not, however, include a generalized interface or standards for exchanging data with CAD systems. The primary intent of the ISN is to extend the reach of existing transportation management and traveler information systems across jurisdictional boundaries. Although data exchange with CAD systems has benefits for all stakeholders, it is out of scope for the ISN.

## *3.5 Assumptions and Constraints*

This subsection describes key assumptions and constraints applicable to the changes and new features identified in this section.

The key assumption in the entire development and deployment of the ISN is that I-95 Corridor Coalition agencies owning and operating transportation management and traveler information systems will in fact modify those systems to support publishing of and subscription to ISN events. The ISN will provide a structure for the exchange of event information, but does not itself provide integration between systems. The value of the deployed ISN to participating agencies depends as much on changes made to their systems as it does on the ISN itself.

In many cases, the changes needed to existing systems will be straightforward. Many of the systems along the corridor already include features supporting the import and export of data. In those cases, participating in the ISN will require only a modification to the existing import and export components to comply with the ISN's data interchange formats.

It may make sense to consolidate these development efforts if the Coalition finds common needs among the systems and agencies intending to participate in the ISN. In that case, the scope of the ISN could be expanded to include gateways for particular systems and types of interfaces.

In addition, the ISN will require ongoing funding to support the maintenance and administration of the system. As described elsewhere in this document, users and systems will be registered into the system, and the registry will require ongoing administration to remain current. Optional features – data archiving, for example – may incur substantial increases in support resources.

# 4 CONCEPTS FOR THE PROPOSED SYSTEM

This section describes the proposed system that results from the desired changes specified in Section 3 of the ConOps document. This section describes the proposed system in a high-level manner, indicating the operational features that are to be provided without specifying design details.

## *4.1 Background, Objectives, and Scope*

The vision for the I-95 Corridor Coalition Information Systems Network is to establish the most effective way for diverse public agencies and jurisdictions along the I-95 Corridor to share information affecting regional transportation operations. Growth and the accompanying traffic congestion along the corridor do not respect historical jurisdictions, and it is increasingly necessary that agencies managing the operations of the transportation infrastructure have access to information beyond their own boundaries. Likewise, the passenger and commercial vehicle drivers need access to information about their entire routes of travel, irrespective of the political and institutional boundaries they may be crossing.

The ISN will enact the means whereby information about travel along the corridor will move across boundaries as easily as the traffic itself. Operators should have access to information about events that may impact their area of control, independent of which agency's monitoring systems are gathering the data. Emergency responders need a consistent and reliable means of obtaining information about events and traffic, especially in disaster scenarios that may fall into multiple jurisdictions. Motorists should see the I-95 corridor as a seamless transportation system providing consistent information according to their expectations. Transportation system managers and traveler information providers want to be able to provide these facilities with minimal new investment and development time, while leveraging their existing systems as much as possible. The challenge is to define and develop an ISN that balances these factors.

## *4.2 Operational Policies and Constraints*

Each agency participating as a publisher or subscriber to information on the ISN will establish policies and operating procedures for use of information as appropriate for that agency. Policies will address information quality assurance standards and procedures for monitoring, measuring, and taking corrective actions. These policies will comply with relevant federal, state, and local regulations.

Interagency agreements may be needed to establish or clarify areas of overlapping or joint responsibility. The ISN concept does not require any agency to give up authority or control over its area of operations, but the exchange of data between geographical and functional jurisdictions will force a critical review and delineation of responsibilities.

Policies and procedures will be established for the administration and maintenance of the ISN. Although most participating agencies will have prior experience with system monitoring and information dissemination, the more open

nature of the network will require an assessment and development of shared policies.

Some shared responsibility and funding will be needed to administer and maintain the common functions of the ISN. Although the proposed system will require only nominal shared human and computing resources, facilities and funding will need to be allocated and administered from among participants to support ISN operations.

## *4.3 Description of the Proposed System*

The ISN is fundamentally a network of transportation information services. It is not a single new information center, or a dedicated workstation, or a specific software package to be distributed to ISN users. The network consists of the existing systems along the I-95 corridor, with new standardized interfaces, and of new management components, user interfaces, and policies needed to make it coherent and cohesive. The existing systems, the new management components, and user interfaces are all services on the ISN.

Users of every system along the corridor want to be able to get information from other systems, and at least some systems need to be able to publish information for others to acquire. Any single system can be a data provider, a data consumer, or both. A request for information starts with a look-up in a directory (or "registry") of services available on the network. All participating systems will be registered on the network as providers and/or users of particular classes of information.

The emphasis of the ISN is on the original event information getting to a new set of users. As such, all other components of the ISN will be as "lightweight" as possible. The registry of ISN services (systems providing information) and users is the essential central component. In all cases, it will be preferred that information be retrieved from the originating service; the registry lets a participating agency know where it can get information, but does not supply the information itself. If a TMC publishes information about an incident, the adjacent TMC should be able to get that information directly from the originating center.

Implementation of message standards is the key enabler of information exchange between systems on the ISN. Independent of developing any shared or central components for the network, providers will need to publish event data in a consistent and known format that is used by all providers.

### 4.3.1 Functional Concepts

Information about an event is published by the agency (and system) in whose jurisdiction or region the event occurs. The information content and format of the publication are prescribed by message standards for the intended application (for example, traveler information or emergency services) and event.

In some cases, operators will want to be alerted to events occurring in other regions. The alerts provide a general description of the event, but do not provide details. More detailed information about the event is either retrieved on demand

("polled") from the originating system or is delivered by subscription to that publication.

Information is retrieved by downstream systems from the originating (existing) service with as few intermediaries as possible. From the standpoint of the requesting system, the information will look as though it were just another event within the system, pulled from a new user or set of detectors or camera.

Information is passed to users through existing system interfaces, or, in those cases where there is no incumbent system, through new generalized interfaces. Users will review the information for its relevance to their operations, and may choose to accept or transfer the information into their own system.

From this point on, transportation management and traveler information system operators act on the information as if it had come from within their own systems. The event information may or may not lead to dispatching event responders and posting traveler information through the existing systems. Updates on the event will continue to be published to the ISN, and operators will continue to monitor the event until it is cleared and closed out.

The integration of external events into the existing systems also offers the possibility of archiving data from across the network into a single archived data management system (ADMS). In this model, the ADMS is just another system on the ISN, subscribed to events from those systems for which data is to be archived.

### 4.3.2 Design Concepts

The exchange of information between participants in the ISN will be based on a publish-and-subscribe model. Providers publish information for the users subscribing to their information service. This model can be implemented in a variety of forms, depending on the preferences of the participating agencies. One strategy is to push the published information directly to subscribers, similar to having mail delivered to an inbox. The opposing extreme is to require subscribers to explicitly ask for an event summary every time they want information. Neither of these, however, is an optimal solution by itself, and it is likely that participating agencies will need options between the two, depending on their internal policies and architectural preferences.

Although it is intended that the existing transportation management and traveler information systems will provide most of the ISN information services, there are several shared services needed to tie the network together. Registration services, as mentioned earlier in the document, will provide a directory of services and users participating in the ISN. In addition, authentication services may be provided to assure that users and services "are who they say they are." In an open network of services, this function assures that a request for information is not coming from someone other than the registered user, or that information pushed from a service is actually coming from the known source. Alternatively, an authorization service could be used for users to log into a service before published information could be retrieved.

These services will likely be built on existing Internet networking protocols and standards. XML data structures based on ITS messaging standards will be used to

publish event information that can be retrieved over the Internet using HTTP/HTTPS protocols. If participating agencies deem it advantageous, the services could be implemented in full SOAP-based Web services. User interfaces for administration will likely be HTML-based.

Existing systems throughout the corridor may require some modification to participate in and benefit from the ISN. As mentioned earlier, participating systems will need to be able to publish data in standards-compliant formats. Likewise, existing systems will need to be able to read these standards-compliant formats in order to present information to operators through the existing interfaces.

### 4.3.3 Performance and Quality Concepts

The proposed ISN provides significant performance and quality advantages over alternative concepts. It is inherently interoperable by its reliance on publishing event messages in industry-standard formats – any system able to read messages in that format is able to use ISN information. Usability is guaranteed by relying on the existing system interfaces to provide operator interfaces. The central registry of services and users allows the network to grow without each system being responsible for administering its own connections, thus providing the same kind of scalability that has allowed the Internet to grow exponentially. The network is also inherently extensible, in that the design concepts can be applied to any message sets for which standards have been (or could be) created.

### 4.3.4 Administrative Concepts

While all existing systems and information services remain controlled by the owning agencies, the ISN's central shared services will likely be independent of those agencies. In the near term, it is expected that the central ISN services would be provided by the Coalition itself, probably through contracted administrative services. The Coalition would also form an ISN Technical Oversight Working Group to provide a technical focus, performance evaluation, and audit of services participating in the ISN.

## *4.4 Modes of Operation*

Because the nature of the ISN is to extend the existing systems' range of information access, there are no changes to the modes of operation described in Section 2.4.

## *4.5 User Classes and Other Involved Personnel*

This section further describes potential users of the ISN described in Section 2.5 to include user's new capabilities and their expected uses of the ISN.

### 4.5.1 Administration

The ISN administration class will be introduced with the implementation of the ISN. This class will establish and administer policies and procedures for the ISN.

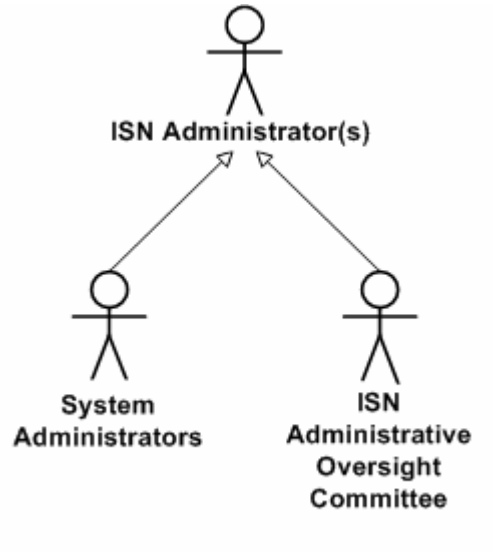


**Figure 3 - Administrator(s)**

***ISN Administrator(s)***

The ISN administrator(s) will be responsible for gathering credentials from subscribing and publishing agencies and upon approval from the administrative oversight committee, will register subscribers and publishers to the ISN.

***ISN Administrative Oversight Committee***

The administrative oversight committee will be responsible for reviewing credentials of potential stakeholders. The oversight committee will ensure that potential stakeholders comply with ISN standards prior to granting access to the system.

### 4.5.2 Operators

Operators at the local, regional, or state level are expected to utilize the ISN by assessing high impact events from outside their service areas and evaluating the impacts of these events on travelers in their service area as they plan and implement traffic management guidelines.

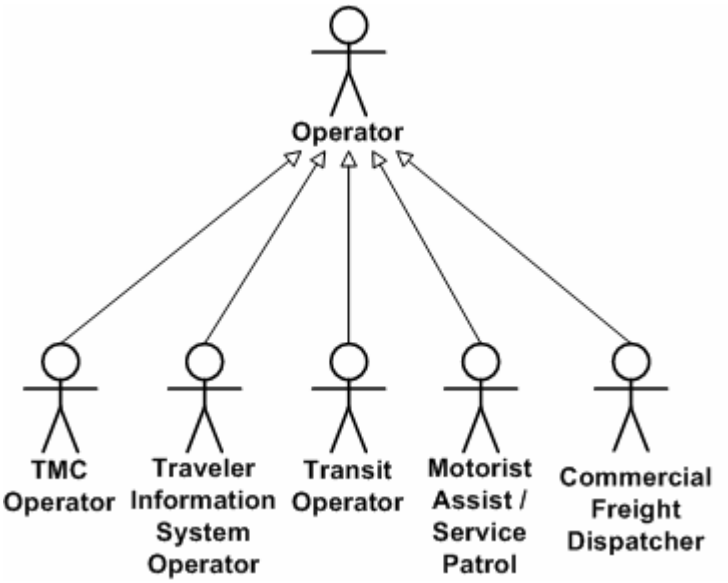


**Figure 4 - Operators**

### *Transportation Management Centers*

Incidents severe enough for the primary TMC to publish to traveler information services will also be added to the ISN. Subscribing TMCs throughout the corridor will assess incidents occurring outside their region to determine if the incident will affect traffic operations in their region. If TMC operators determine the incident will affect their region of operations, operators will consult with the primary TMC to establish alternate routes.

### *Motorist Assist and Service Patrols*

Motorist assist/service patrols are expected to utilize the ISN to access high impact events from outside their service areas and evaluate these events as they plan and implement traffic control for events occurring within their area. For example, a major incident one county away may cause the motorist assist/service patrol personnel to reroute a detour in their area due to increased traffic volume caused by the neighboring region's incident.

### *511 System Operations*

511 systems may use information from the ISN to develop messages that will be included in a 511 call. These messages may be in the form of informational advisories concerning major events several hours or states away including anticipated delays and expected clearance times. Alternate route advisories may also be offered during the duration of the event. In the case of major road closures lasting for long periods of time, flood gate messages may also be posted on the 511 system. This can assist in mitigating the effects of major incidents or road closures along the I-95 corridor.

### *Transit Operators*

It is anticipated that transit operators will use information from the ISN to inform transit drivers and transit riders of incidents affecting transit operations. Transit operators will reroute transit drivers and inform transit riders by posting incident information to transit websites and informing riders who call in to check schedules.

### *Commercial Freight Dispatchers*

Commercial freight dispatchers may wish to monitor incidents along the corridor in order to notify commercial freight drivers of incidents that may affect delivery schedules and provide alternate route recommendations. Advanced notice of roadway incidents will allow commercial freight dispatchers to map out the most efficient route for deliveries.

### *Traveler Information Services*

Traveler information services such as 511, DMS, HAR, and transportation websites will make incident information available to the general public, allowing them to make informed decisions regarding their travel plans.

## 4.5.3 Travelers

Travelers include private vehicle drivers, commercial and public transit riders, commercial and public transit drivers, and commercial freight drivers. Although travelers will not obtain information directly from the ISN, information published on the ISN will be reviewed by operators and passed on to travelers by radio or traveler information services. Information provided to travelers about road conditions, transit schedules and fares, attractions, navigational instructions, etc. will allow them to make informed decisions about their travel patterns.

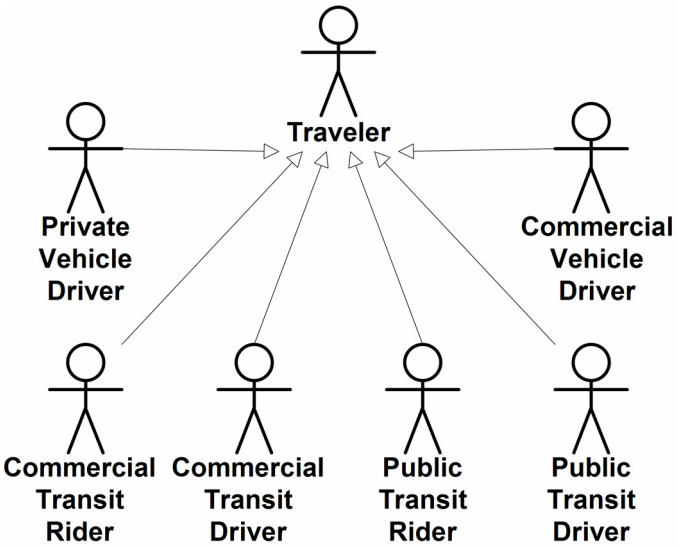


**Figure 5 - Travelers**

### *Private Vehicle Travelers*

Private vehicle travelers will receive information about incidents through traveler information services such as 511, HAR, DMS, and the Internet. Providing private vehicle travelers with information on degraded road conditions or events in neighboring regions will allow travelers to reroute or make other travel arrangements.

### *Commercial Transit Riders*

Delays or emergency incidents in a region's commercial transit system may affect transit schedules in neighboring regions. However, commercial transit riders will not receive information directly from the ISN. Information shared over the ISN about delays, emergencies, or other incidents will be passed to commercial transit riders when they seek out transit information by phone, websites, from commercial transit drivers, or other traveler information services.

### *Commercial Transit Drivers*

Commercial transit drivers will not receive information directly from the ISN. However, they will receive incident information from transit operators and other traveler information services. Commercial transit drivers will inform commercial transit riders using the transit system of incidents.

### *Public Transit Riders*

Much like commercial transit riders, public transit riders will not receive information directly from the ISN. Information shared over the ISN about delays, emergencies, or other incidents will be passed to public transit riders when they seek out information by phone, websites, from public transit drivers, or other traveler information services.

### *Public Transit Drivers*

Similar to commercial transit drivers, public transit drivers will not receive information directly from the ISN. However, they will receive incident information from public transit operators and other traveler information services. Public transit drivers will inform public transit riders using the transit system of incidents.

### *Commercial Freight Drivers*

How a commercial freight driver receives incident information may depend on the responsibilities of commercial freight dispatchers. Just like private vehicle drivers, commercial freight drivers can access any traveler information system (such as 511, DMS, or HAR) to obtain incident information and roadway conditions. However, some freight companies may require commercial freight dispatchers to monitor traveler information systems and map out alternate routes for commercial freight drivers.

### 4.5.4 Emergency Responders

Emergency responders include fire and police departments, emergency management agencies, emergency medical services, and other emergency rescue agencies. Emergency responders are typically dispatched to an incident by a 911 dispatcher. 911 dispatchers may only provide minimal information about an incident. Agencies may wish to obtain information from the ISN concerning roadway conditions in local or surrounding jurisdictions that may delay timely arrival to the incident scene.

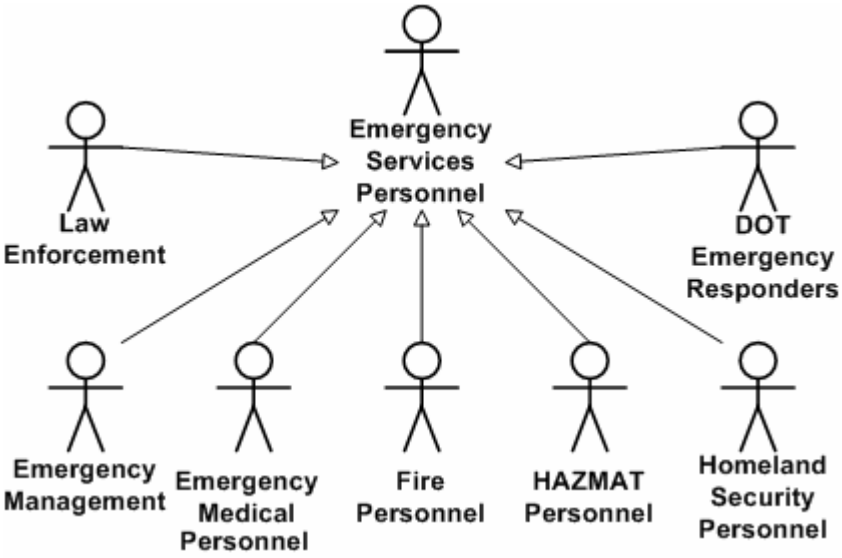


**Figure 6 - Emergency Responders**

#### *Law Enforcement Agencies*

Law enforcement agencies (LEA) are one of the first agencies to arrive at the scene of an incident. LEAs are dispatched by a 911 operator and receive very limited information about the situation. LEAs may wish to obtain additional information, such as traffic patterns in surrounding jurisdictions that may affect timely arrival.

#### *Emergency Management Agencies*

It is anticipated that EMAs will utilize the ISN by accessing high impact events from outside their normal operational area and manually accessing the impact of these events on emergency response/evacuation route selection. For example, a preselected emergency or evacuation route is of no use if portions of the route are closed due to an event.

#### *Emergency Medical Personnel*

Emergency medical personnel are dispatched by 911 operators and are often one of the first agencies to arrive at the incident. It is vital that emergency medical personnel arrive as quickly as possible. Operators may pass information to emergency medical personnel about incidents in neighboring jurisdictions that may affect normal travel patterns.

### *Fire Departments*

Much like emergency medical personnel, fire departments are dispatched to an incident by a 911 operator and are also one of the first agencies to arrive at the scene. Fire departments may use information from the ISN about roadway conditions in neighboring jurisdictions and choose to reroute travel patterns.

### *Hazardous Material Management*

HAZMAT professionals may publish information to the ISN to provide recommended actions for incidents involving hazardous materials. Recommended actions may include evacuation of areas or rerouting traffic.

### *DOT Emergency Responders*

DOT emergency responders may utilize the ISN to discover information about incidents in surrounding jurisdictions that affect operations in their local jurisdiction and require immediate attention. Receiving notification of incidents in surrounding jurisdictions, DOT emergency responders can prevent or lessen traffic delays resulting from those incidents.

### *Homeland Security*

It is anticipated that the Department of Homeland Security will use the ISN to identify terrorist attacks that have occurred and provide transportation agencies and the public with information about potential attacks.

## 4.5.5 Maintainers

Maintainers are responsible for restoring normal operations and opening the roadway to traffic. Maintainers may use information from the ISN to assist in achieving and maintaining normal operations during their clean-up and restoration activities.

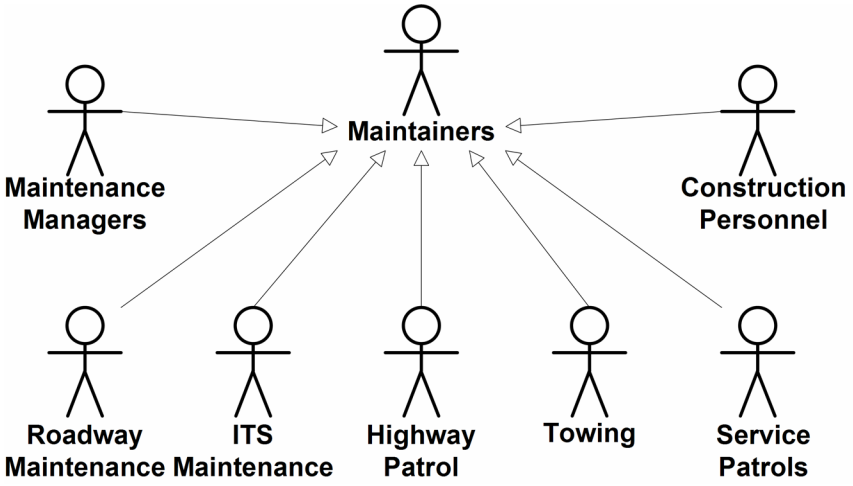


**Figure 7 - Maintainers**

### *Maintenance Management*

It is anticipated maintenance management will utilize information from the ISN to schedule maintenance activities. Management may not want to schedule activities in an area that will already be affected by maintenance activities of another jurisdiction. However, if work must be completed, maintenance management may use information from the ISN to establish detours.

### *Roadway Maintenance Workers*

Roadway maintenance workers most likely will not interface directly with the ISN. However maintenance management and operators may pass information about roadway conditions to roadway maintenance workers.

### *ITS Maintenance Workers*

Similar to roadway maintenance workers, ITS maintenance workers will most likely not interface with the ISN but will receive information from other sources such as maintenance management and operators.

### *Highway Patrol*

It is expected that highway patrol agencies will use the ISN to assess high impact events from outside their service areas and evaluate the impacts of these events on travelers in their area.

### *Towing*

Towing companies may use information on the ISN to determine when and to what extent their services are needed. They may also check a desired route for delays prior to departure.

### *Service Patrols*

Service patrols may provide information about incidents and roadway conditions to operators for input into the ISN.

### *Construction Personnel*

Construction personnel will receive information about roadway conditions from maintenance management.

## *4.6 Support Environment*

The existing transportation management and traveler information systems will continue to be supported by their owning agencies. Subscribing agency systems must comply with ISN standards prior to publishing or receiving information from the ISN. Owning agencies will be responsible for making changes or upgrades to their systems in order to achieve ISN standards compliance. New transportation management and traveler information systems along the corridor will be responsible for their own administration and support, but may be better positioned to take advantage of the capabilities provided by the ISN.

# 5 OPERATIONAL SCENARIOS

A scenario is a step-by-step description of how the proposed system should operate and interact with its users and its external interfaces under a given set of circumstances. The following scenarios will allow readers to walk through activities and gain an understanding of how the various parts of the proposed system function and interact. The scenarios will tie together the system, the users, and other entities by describing how they interact.

In scenarios where it is necessary for a [Primary TMC] to consult with a [Secondary TMC], ISN users should reference contact information provided in the ISN.

## *5.1 Subscribing to the Information Systems Network*

A key component of the ISN will be the registry of information subscribers and providers within the network. Subscribing agencies (system stakeholders) will use this registry to discover information on the ISN and to contact those agencies providing the information.

When an [Agency] determines that it wants to get information from a neighboring system the [Agency] submits their credentials to the ISN administrator. The ISN administrative oversight group clears the [Agency] for subscription to the ISN. The ISN administrator registers the [Agency] to the ISN.

## *5.2 Publishing to the Information Systems Network*

As discussed in the previous scenario, a key component of the ISN will be the registry of information subscribers and providers within the network. Information providers will publish information to the locations and in the formats specified in the registry.

When an [Agency] determines that it wants to publish information to the ISN the [Agency] must assure that the [System] providing information to the ISN complies with ISN standards for publication. The [Agency] will submit its credentials to the ISN administrator. ISN administrative oversight group clears the [Agency] for publishing to ISN and the ISN administrator registers the [System] in ISN.

## *5.3 Operation without Incidents*

TMCs monitor traffic conditions through various sources, including: the ISN, CCTV, speed sensors, and other intelligent transportation systems. When TMC operators discover incidents, they assess the situation and provide information to other agencies and the traveling public. If a TMC does not encounter any unusual situations, no information is published to the ISN, DMS, HAR, or 511 systems. Websites show traffic moving at normal speeds.

## *5.4 Highway Incident*

In some situations, an incident that affects the primary TMC may not have an impact on a secondary TMC. In this scenario, a multi-vehicle crash occurs on a

major highway. [TMC1] detects slow moving traffic as a result of the crash. [TMC1] operators assess the situation and determine the effects are serious enough to publish information to the ISN, DMS, HAR, and 511.

[TMC2] discovers information about the multi-vehicle crash and its effects on traffic. [TMC2] determines that the event will not affect its region of operations and takes no action. [TMC1] will continuously publish updates about the incident to the ISN, therefore [TMC2] will monitor updates to determine if action should be taken at a later point in time.

When the incident is cleared, [TMC1] publishes the update to the ISN and closes the event. [TMC2] receives the update, since no actions were taken in response to the incident, no actions are taken in response to its cancellation.

## *5.5 Exceptional Congestion*

A transit system outage occurs, forcing commuters to use other modes of transportation. A large portion of these travelers will choose to travel in private vehicles. The potential of an increased number of private vehicles on the roadways threatens to significantly impact highway traffic conditions. Realizing the severity of the situation, [TransitMC] publishes information about the outage on their website, the ISN, and notifies the media.

As [TMC3] is monitoring traffic events, operators discover information about the transit outage on the ISN. [TMC3] assesses the situation and determines that the transit outage may significantly increase congestion in its region of operations. [TMC3] publishes information about the outage to DMS, HAR, 511, and other traveler information systems in their area.

Until the outage is resolved, [TransitMC] continuously publishes updates to the ISN. When [TransitMC] recovers from the outage, they publish an update to the ISN and close the event. [TMC3] receives the update, removes messages from traveler information systems, and closes the event.

## *5.6 Work Zone*

Pre-planned work or events should be (although are not always) coordinated with neighboring agencies prior to publishing information to the ISN. This scenario is an example of a work zone event that was not coordinated with neighboring agencies prior to publishing the event to the ISN.

[TMC4] has planned a work zone for a segment of highway in their region of operations. [TMC4] works to establish an operating plan to provide alternate routes and traveler information during the period of abnormal operations. [TMC4] does not expect the work zone event to affect operations in the [TMC5] region and therefore does not notify them prior to publishing the event to the ISN.

[TMC5] discovers the upcoming event information on the ISN and determines that the event will affect patterns in its region of operation. [TMC5] consults with [TMC4] to prepare traveler information for alternate routes and publishes the information to DMS and HAR during work zone operations.

[TMC4] publishes any changes in work zone operations to the ISN. [TMC5] updates traveler information systems as needed. When work zone operations are complete, [TMC4] publishes an update and closes work zone messages. [TMC5] receives the update and closes messages they have initiated. Normal operations have resumed.

## *5.7 Winter Weather*

A winter weather advisory indicates that a nor'easter is due to pass through the eastern seaboard. Agencies in adjoining jurisdictions will be affected differently, with snowfalls varying drastically in a single jurisdiction and from one jurisdiction to another. If the storm moves quickly, cold rain or snow may fall for six to eight hours. If the warm air stalls against a high pressure wall, the snowfall may last 24 hours or more, as it has done in the past. Roadways, transit transportation services, businesses, and possibly entire cities or states may close as a result of the storm conditions. Agencies are limited to the amount of information available for publishing prior to the onset of the storm. However, they will work together prior to the storm to provide traveler guidance before entering regions with potentially dangerous road conditions.

Multiple agencies will publish information about road and weather conditions to the ISN during the storm. For this scenario, multiple agencies are referred to as "[TMCs]" and a single agency is referred to as "[TMC7]".

The nor'easter sets in, and as expected, snowfall amounts range drastically throughout the eastern seaboard. [TMCs] publish a variety of winter road operation messages to DMS and HAR in their respective region and to the ISN. 511 systems throughout the eastern seaboard get event information from the ISN and formulate and publish broadcast messages to their region of operations. The following are examples of messages that may be published to the ISN:

- Philadelphia: "I-95 – Icy road conditions"
- Philadelphia: "I-476 – 4 feet of snow"
- New York City: "Staten Island – 70 mph winds, blizzard conditions, low visibility"
- Connecticut: "I-95 closed from Greenwich to New Haven, use alternate route"

[TMC7] determines that operations in two [TMCs] may affect traffic patterns in its region of operations. [TMC7] disregards information that does not affect its region of operations and locates contact information for appropriate [TMCs], which may be found in the ISN Contact Database. [TMC7] works with the two [TMCs] individually to prepare traveler information on alternate routes between their regions of operation. [TMC7] publishes information to DMS and HAR regarding winter conditions and alternate routes for travelers entering the neighboring region.

Surrounding [TMCs] continuously publish updates to road weather conditions. As storm conditions subside and winter operations cease, the [TMCs] publish updates and close winter operation messages. 511 systems receive updates and remove

messages from traveler information services. [TMC7] receives the updates and removes messages for the respective region.

## 5.8 HAZMAT Closure

A multi-vehicle crash occurs on a major highway, resulting in an emergency operating mode requiring extensive emergency response operations. An overturned tractor trailer leaking diesel fuel and hydraulic oil has blocked traffic and caused congestion to build up around the incident. Emergency services personnel, at the scene of the crash, discover the hazardous material spills, close the highway, and request HAZMAT response.

[TMC8] detects the incident remotely, surveys the scene, and publishes event information to DMS and HAR in their jurisdiction. Event information is picked up by the 511 system and the ISN. [TMC9] discovers event information on the ISN and determines that operations in [TMC8] region will affect traffic patterns in its region of operations. [TMC9] consults with [TMC8] to prepare traveler information for alternate routes. [TMC9] publishes information to DMS and HAR on [TMC8] closure and alternate routes. Meanwhile, HAZMAT works diligently at the scene of the spill to prevent any material from entering the stormdrain system and any subsequent natural waterways.

[TMC8] continues to monitor the event and publish updates to ISN. [TMC9] evaluates updates to determine if any changes need to be made to traffic patterns. The incident is cleared and HAZMAT assures that the hazardous material spills are fully remedied. [TMC8] publishes an update and closes event. [TMC9] discovers the update, removes closure and alternate route messages.

## 5.9 Weather Closure

This scenario builds on the "Winter Weather" scenario, moving from an abnormal mode to an emergency mode.

A nor'easter has swept through an agency's region of operations. Snowdrifts have blocked segments of major highways. The major portion of the region monitored by [TMC10] has been officially closed down by order of the Governor. Surrounding regions use information from the ISN to inform travelers of alternate routes prior to reaching a segment of closed highway.

[TMC10] publishes notice of closed roadways on DMS and HAR. Road closures are picked up on 511 systems and the ISN. [TMC11] discovers event information on the ISN and determines that operations in [TMC10] region will affect traffic patterns in its region of operations. [TMC11] consults with [TMC10] to prepare traveler information for alternate routes. [TMC11] publishes event information to DMS and HAR on [TMC10] winter conditions and alternate routes. [TMC10] continuously publishes updates to the ISN and [TMC11] evaluates updates to determine the impact on its region of operations.

After several hours, winter weather conditions subside and maintenance crews clear roadways. As roadways are cleared and reopened, [TMC10] publishes updates and closes winter weather messages. 511 systems and [TMC11] receive updates and remove winter weather messages.

## 5.10 Hurricane Evacuation

Officials issue a mandatory hurricane evacuation and implement lane reversal plans. Transportation operations are affected across multiple regions and responding agencies. [TMC12] publishes notification of evacuation routes and lane reversals on DMS and HAR. Event information is picked up on 511 systems and the ISN. [TMC13] discovers event information on the ISN and determines that operations in [TMC12] region may affect traffic patterns in its region of operations. [TMC13] consults with [TMC12] to prepare traveler information on alternate routes.

If necessary, [TMC13] may initiate lane reversals on select roadways to support traffic patterns and allow for maximum outbound use. [TMC13] publishes event information to DMS and HAR on [TMC12] hurricane conditions and alternate routes. [TMC12] continuously publishes updates to ISN and [TMC13] monitors updates to determine if changes should be made to traffic operations.

Hurricane conditions clear and maintenance personnel from stakeholder agencies clear debris and begin repairing damaged roadways. As roadways are reopened, [TMC12] publishes updates and closes hurricane evacuation messages. [TMC13] and 511 service receive updates and remove hurricane evacuation messages.

## 5.11 Terrorist Act

This scenario describes the response to a terrorist act requiring TMCs to function in disaster operating mode with extensive emergency response operations. Terrorists rammed a barge carrying flammable materials into a major bridge causing severe damage and rendering the bridge impassible. Traffic and waterway operations experience considerably degraded operations.

Emergency Services stakeholders and operators close the bridge and highway approaches. [TMC14] publishes notice of the closed bridge on DMS and HAR. Event information is picked up on the ISN and 511 system. USCG Captain discovers event information on the ISN and closes down the waterway. USCG Captain works with neighboring agencies to redirect watercraft to surrounding ports.

[TMC15] discovers event information on ISN and determines that traffic operations in [TMC14] region may affect traffic operations in its region. [TMC15] consults with [TMC14] to prepare traveler information on alternate routes. [TMC15] publishes traveler information to DMS and HAR regarding [TMC14] bridge closure and alternate routes. [TMC14] continuously publishes any changes in events to the ISN. [TMC15] monitors updates for changes or notice that the events have cleared.

The waterway is reopened to watercraft during reconstruction of the bridge. When construction is complete, the bridge is reopened and normal traffic operations resume. [TMC14] publishes an update and closes messages. 511 service and [TMC15] receive the update and remove messages.

# 6 SUMMARY OF IMPACTS

This section describes the operational impacts of the proposed system on the users, the developers, and the support and maintenance organizations. It also describes the temporary impacts on users, buyers, developers, and the support and maintenance organizations during the period of time when the new system is being developed, installed, or trained on.

## *6.1 Operational Impacts*

The intent of the changes described in this Concept of Operations is to make as little change to existing operating procedures as possible, while expanding the "field of view" of the operators. These enhancements would extend the geographical and operational reach of the management and operations centers by providing data from similar systems through the existing user interfaces. Automation of the information exchange would minimize any incremental workload to operators.

The ISN concept does include provisions for extended access to information beyond the existing operator stakeholders. The ISN is intended to be "participant neutral:" it specifies standards, advises agency implementation, and facilitates communication, but it does not mandate specific system changes or implement yet another all-in-one solution. It does provide a minimal user interface, in the form of the "event browser," to provide independent access to ISN content. These concepts work together to provide access for new stakeholder agencies to assess the value of sharing event information along the corridor. There is, therefore, the potential for ISN participants to deepen or find new institutional relationships where the exchange of data may not have previously been possible or effective.

The ISN would require some new administrative effort to build and maintain the interfaces between the systems. Changes affecting the data published from any system on the network would need to be evaluated for their impact on other systems and operations.

## *6.2 Organizational Impacts*

Development and deployment of the ISN will require technical, administrative, and financial resources.

- Establishing effective standards and procedures for information exchange will need a team of technical representatives from Coalition member agencies and supporting system vendors.
- Making system modifications to publish and ingest the information from other systems on the ISN will require agency technical and financial resources.
- Development of the central integrating components of the ISN will require financial resources and appropriate technical resources.

The intent of the ISN as described in this Concept of Operations is to require as few operating resources as possible. Once the system is in place, routine

operations will depend on the diligence of information publishers and subscribers on the ISN. Ongoing resource needs would be limited to providing oversight of ISN participation and operation, hosting the ISN core services, and administering the ISN registry.

## *6.3 Impacts During Development*

Impacts on ongoing agency operations during development of the ISN will be minimal. The intent is to supplement and enhance existing systems and operations, not replace them. As such, operation of existing transportation management and traveler information systems will not be affected.

Participating agencies will independently need to be assessing and modifying their systems as needed to provide information to and use information from other systems on the network. Since these functions are adjuncts of the existing operations, development and deployment of those capabilities likewise should not significantly affect ongoing operations.

# 7 ANALYSIS OF THE PROPOSED SYSTEM

This section provides an analysis of the benefits, limitations, advantages, disadvantages, and alternatives and trade-offs considered for the proposed system.

## *7.1 Summary of Improvements*

The ISN allows participating agencies to extend the reach of their existing management and operations systems by an open exchange of event information with similar or related systems. Jurisdictional boundaries in transportation information will become only as visible as the boundaries in the transportation system itself. Information will be more continuous, consistent, and concise. Data will be available from other jurisdictions as if it originated from within an agency's own system. Although interagency communications will still depend on the relationships between the agencies' management and operations personnel, the ISN will provide a common base for information exchange to which those management and operations discussions can refer.

Once established, the ISN also becomes a standardized base of operating information for providing new access to agencies, commercial interests, and other users who previously did not want or have access to such information. The objectivity and accessibility of the data are likely to find innovative applications by a broader variety of stakeholders than are currently engaged with Coalition members.

## *7.2 Disadvantages and Limitations*

Although the ISN concept provides significant flexibility in terms of the data to be exchanged and conditions to be met by participating agencies, those advantages are the source of some limitations in its deployment and operations.

First and foremost: there will be no data on the ISN to subscribe to, and therefore no value in participation, until member agencies are publishing data. At least one participant must be willing to develop the ability to publish information out of their existing system, in the prescribed format, before anyone can subscribe. The risk to the first agency to take this step is that they may be the only agency to do so, and their investment would be significantly devalued. This concern could be mitigated by concurrent development between lead agencies willing to undertake that risk with the assurance of being able to exchange data with each other.

In a similar vein, the ISN does not provide information independent of the participating agencies and systems. Only the data acquired by the participating agencies through their existing system would be published to the network. The ISN concept does not include any new detection devices or field sensors, so corridor-wide system information is not increased.

The independence of the participating agencies as information providers creates an open market for the event data. As in any other product market, the quality of the data will be subject to the limitations of each participating agency. Any administrative oversight of data quality across the network would be subject to the agencies' willingness to adhere to the standards and to participate in audits.

Once data becomes available through the ISN, transportation management and traveler information system operators will face the challenge of monitoring the network and assimilating the data. This may substantially increase the amount of information that system operators have to review and manage.

## *7.3 Alternatives and Trade-offs Considered*

This subsection describes major alternatives considered, the trade-offs among them, and rationale for the decisions reached. This information may be useful when considering the bases for requirements and design decisions later in the system development life cycle or in subsequent system analyses.

The simplest and least expensive alternative may be to do nothing. Agencies along the corridor already share information through existing means of communication, when necessary, to preserve effective operations. This option presumes that existing information sharing meets a minimum acceptable standard, and that the expected cost of improvements would exceed any benefits to be gained. Since there is general agreement among stakeholders that the current situation is not adequate to meet that minimum standard, doing nothing is not a viable option.

At the simplest level of cooperation, each agency could develop its own information sharing agreements and operations with other agencies along the corridor. The primary advantage of this approach is that costs and benefits would accrue to only those agencies truly needing to exchange information. The disadvantage is that the costs are not shared among more agencies. Each such agreement duplicates much of the cost of the last such agreement. Each such agreement furthermore becomes an independent opportunity to negotiate new technical standards for data exchange. The net result would provide exchanges between specific agencies for specific circumstances, but would not provide general interoperability along the corridor.

The scope of the ISN could be limited to sharing only the highest value, lowest cost data, probably in the form of alerts. This option would hold participating agencies to a minimal investment and few changes to existing systems. Any detailed exchange of information could go through existing channels or through a new informal network of contacts in each participating agency. The critical disadvantages of this option are that it creates more demands on an operator's attention (based on additional alerts), but does not substantially improve the ability to share information. Once operators were alerted, they would need to find and contact the appropriate agency operators to get any actionable information.

The ISN concept described in Section 4 of this document is based explicitly on sharing information between systems. "Sharing" the information implies that ownership is understood to remain with the originator; other users are "borrowing" the information to do something else with it. This model has the key advantage of inherently identifying the party (agency) responsible for the data, because the system knows from whom it initially obtained the information. Alternatively, the ISN could be built as a system that consolidates the information, rather than sharing it. This option would create a repository for information that is provided by, but operationally independent of any of the

originating agencies. Other users would obtain information from the repository, but not have any direct access to the originating agency. The major disadvantage of this approach is that responsibility for the information devolves to the system (and its administrators). This centralization of responsibility would require a corresponding authority and inevitably lead to increased administrative costs.

The increased administrative costs for participating agencies associated with a centralized repository could be mitigated by externalizing those costs. The Coalition could create or augment incentives for a third party to build a system to consolidate and distribute the data. This arrangement is typical of public/private partnerships that attempt to obtain some public benefit (in this case, a facility for exchanging operations information) in exchange for a profit-generating opportunity. Participating agencies could minimize their costs, but would give up some control over the information and its use. This approach can be made to work, but generally involves significant compromises on the part of the public agency. In particular, such arrangements usually involve constraints on the scope of data available to the participating agencies and on their ability to redistribute the data. Even if the original agreement is executed in good faith and with technical rigor, the contractual entanglements make it difficult to expand or modify the system without providing additional incentives to the consolidator.

# APPENDIX A - DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

The following table provides the definitions of all terms, acronyms, and abbreviations required to properly interpret this Concept of Operations.

| Term | Definition |
|---|---|
| #77 | Cellular call in system for motorists to report traffic incidents. |
| 24/7 | 24 hours a day, 7 days a week. |
| 511 | Abbreviated dialing code for a telephone-based traveler information system often using interactive voice technology. |
| AASHTO | American Association of Highway and Transportation Officials |
| ADMS | Archived Data Management System |
| AMBER | America's Missing Broadcast Emergency Response |
| ATIS | Advanced Traveler Information System. |
| ATMS | Advance Traffic Management System |
| AVL | Automatic Vehicle Location |
| CapCOM | Washington D.C. capital area communications center |
| CapWIN | Capital Wireless Integrated Network. |
| C2C | Center-to-Center. |
| CAD | Computer-Aided Dispatch. |
| CARS | Condition Acquisition and Reporting System. |
| CC | Corridor Coalition. |
| CCTV | Closed Circuit Television. |
| CHART | Coordinated Highways Action Response Team. |
| ConOps | Concept of Operations. |
| CRS | Condition Reporting System. |
| CTIS | Corridor-wide Traveler Information System. |
| DE | Data Element |
| DMS | Dynamic Message Sign. |
| DOT | Department of Transportation. |
| EMA | Emergency Management Agency. |
| ETC | Electronic Toll Collection. |
| ETIS | Evacuation Traffic Information System |

| Term | Definition |
|---|---|
| Event | Any occurrence, planned or unplanned, with potential or actual impact on the transportation system; in most cases, an incident or special event. |
| GIS | Geographic Information System. |
| HAR | Highway Advisory Radio. |
| HAZMAT | Hazardous Material. |
| HERO | Highway Emergency Response Operators |
| HOV | High Occupancy Vehicle. |
| HTML | HyperText Markup Language |
| HTTP/HTTPS | HyperText Transfer Protocol/Secure HyperText Transfer Protocol |
| ICAT | Integrated Corridor Analysis Tool. |
| IDAS | ITS Deployment Analysis System. |
| IEEE | Institute of Electrical and Electronics Engineers. |
| IEN | Information Exchange Network. |
| Incident | Any non-recurring event, which results in damage to the roadway, reduction in roadway capacity, or an increase in traffic demand. These include predictable events, such as work zones, major sporting events, parades, concerts, and unpredictable events, such as accidents, stalled vehicles, weather events, earthquakes, hazardous material spills, acts of terrorism, and structural failures (such as a collapsed bridge or a washed-out road). Each of these can result in considerable congestion, delay, seconday accidents, closed roadways, and traffic detours. |
| IRRIS | Intelligent Road/Rail Information Server |
| ISN | Information Systems Network. |
| ITE | Institute of Transportation Engineers |
| ITMS | Interim Traffic Management System. |
| ITS | Intelligent Transportation System. |
| LAN | Local Area Network |
| LEA | Law Enforcement Agency. |
| MDC | Mobile Data Computer |
| NJDOT | New Jersey Department of Transportation |
| NYPD | New York City Police Department |
| OSI | Open System Interconnection |

| Term | Definition |
|---|---|
| PennDOT | Pennsylvania Department of Transportation |
| RA | Regional Architecture |
| RIMIS | Regional Integrated Multi-Modal Information Sharing. |
| RTIC | Regional Traveler Information Center. |
| SAE | Society of Automotive Engineers. |
| SMART | System Management for Advanced Roadway Technologies. |
| SmartNET | Syracuse Metropolitan Area Regional Transportation NETwork. |
| SOAP | Simple Object Access Protocol |
| SOC | Statewide Operations Center. |
| TARS | Traveler Advisory Radio System. |
| TCC | Traffic Control Center |
| TIMS | Traveler Information Management System. |
| TMC | Transportation Management Center or Traffic Management Center. |
| TMDD | Traffic Management Data Dictionary |
| TOC | Traffic Operations Center. |
| TRANSCOM | Transportation Operations Coordinating Committee |
| TRANSMIT | TRANSCOM System for Managing Incidents and Traffic |
| TRIO | Traveler Information Online. |
| VDOT | Virginia Department of Transportation. |
| VDS | Video Detection System |
| WAN | Wide Area Network |
| XML | Extensible Markup Language |

# APPENDIX B - REFERENCED DOCUMENTS

The following documents contain additional information pertaining to this project or have been referenced within this document:


- American Association of State Highway and Transportation Officials, and Institute of Transportation Engineers, *ITE TM 1.03 – Standard for Functional Level Traffic Management Data Dictionary (TMDD).*
- American Association of State Highway and Transportation Officials, and Institute of Transportation Engineers, *ITE TM 2.01 – Message Sets for External Traffic Management Center Communication (MS/ETMCC)*; Rev. 1.1; February. 26, 1999.
- Capital Wireless Integrated Network. <http://www.capwin.org >.
- Capital Wireless Integrated Network, *Strategic Plan 2001 – Updated for 2002-2003*. November 15, 2002.
- CARS – Condition Acquisition and Reporting System. <http://www.carsprogram.org/public.htm>.
- Castle Rock Consultants, Projects, *iFlorida*. <http://www.crc-corp.com/projects/iflorida.htm>.
- Castle Rock Consultants, Projects, *New York Information Exchange Network (IEN)*. <http://www.crc-corp.com/projects/newyorkien.htm>.
- Castle Rock Consultants, Services, *Condition Reporting Systems.* <http://www.crc-corp.com/>.
- City of Orlando, Traffic Management Center Webpage. 2004. <http://www.ci.orlando.fl.us/public_works/traffic/tmc.htm>.
- Delaware Department of Transportation. <http://www.deldot.net/index.shtml>.
- Delaware Valley Regional Planning Commission, *Request for Qualifications for Regional Integrated Multi-Modal Information Sharing System (RIMIS).* 2004.
- Federal Highway Administration Operations, *Current Program Activities.* December 2004.
- Florida Department of Highway Safety and Motor Vehicles, *Quarterly Report July – September 2004*.
- Florida Department of Transportation, *511® Traveler Information Telephone Number Program Support Assistance Program.* January 3, 2002.
- Florida Department of Transportation District 4 SunGuide TMC, *SMART SunGuide TMC FDOT D4*. 2005. <http://www.smartsunguide.com/sunguide.aspx>.
- Florida Department of Transportation, *iFlorida – Background.* <http://www.iflorida.net/background.htm>.
- Florida Department of Transportation, *Tampa Bay Traffic and Travel Information.* <http://www.511tampabay.com/>.
- Georgia Department of Transportation, *NAVIGATOR.* 2003. <http://www.georgia-navigator.com/>.

- I-95 Corridor Coalition, *An Assessment of Existing Information Sharing and Analysis Tool.* May 28, 2004.
- I-95 Corridor Coalition, *Corridor News – Award Winning SunGuide ITS Traffic Management Center Opening in June*. Spring 2004, Volume 12, Issue 1.
- I-95 Corridor Coalition, *Intermodal Passenger Travel Information Phase 2A – Final Report.* December 2003.
- I-95 Corridor Coalition, *Intermodal Passenger Travel Information System Project Status – Presentation to the Intermodal Passenger Subcommittee.* May 23, 2002.
- I-95 Corridor Coalition, *Intermodal Passenger Travel Information System Proposed Plan for Stage 1 Pilot Test – Presentation to the New Jersey Transit Corporation.* July 22, 2002.
- I-95 Corridor Coalition, *Network Development Scope of Work*. March 17, 2004.
- I-95 Corridor Coalition, Reports and Projects, *Information System Network Concept and Architecture*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Integrated System for Corridor Operations and Management – ISCOM also known as "Integrated Corridor Analysis Tool" or ICAT.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Interagency Communications.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: 6 – User Needs and Marketability.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: 6 – User Needs and Marketability: Develop Market Research Program*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: 6 – User Needs and Marketability: Executive Summary (Assessment of User Information Needs and Technologies Preferences).* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: 6 – User Needs and Marketability: Executive Summary (Determine Market Potential: Technical Report).* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: 6 – User Needs and Marketability: Final Report.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 6-5A – Passenger #3: Intermodal Passenger Travel Information System: Phase I – Implementation Strategy.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 6-5A – Passenger #3: Intermodal Passenger Travel Information System: Phase I – Implementation Strategy: Proposed Project Statement/Work Plan.* January 24, 2002.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 7a-2A, 8a-2A, 9a-2A, & 10-2A – Rural Advanced Traveler Information System (RATIS) Tri-State TRIO.* <http://www.i95coalition.org>.

- I-95 Corridor Coalition, Reports and Projects, *Project Number: 8 – Traveler Information Services (TIS)*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: 8 – Traveler Information Services (TIS): Executive Summary*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: 8 – Traveler Information Services (TIS): Final Report*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 8-5C & 9-5C – Intermodal Passenger Travel Information System Phase IIA (Market Assessment and Operating Framework) and Phase IIB (Operating Prototypes and Business Model)*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 8-5C & 9-5C – Intermodal Passenger Travel Information System Phase IIA (Market Assessment and Operating Framework) and Phase IIB (Operating Prototypes and Business Model)*: *Preliminary Draft Proposal for Intermodal Passenger Travel Information System Phase III – Prototype Operational Test.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 9-5C – Passenger Project #1: Intermodal Passenger Travel Information System: Phase 3.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 9-5C – Passenger Project #1: Intermodal Passenger Travel Information System: Phase 3: Intermodal Passenger Travel Information System Phase 2B Operating Prototypes and Evaluations Statement of Work.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 10-5C – Intermodal Passenger Travel Information System Phase III – Deployment Planning and Agreements.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Code: 10-5C – Intermodal Passenger Travel Information System Phase III: Intermodal ATIS Project: Combined Work Program 2004 – 2005.* <http://144.202.240.28/pman/projectmanagement/Upfiles/scope/83.pdf>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: FOT-1 – Information Exchange Network – IEN.* <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: FOT-1 – Information Exchange Network – IEN: Executive Summary*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: FOT-1 – Information Exchange Network – IEN: IEN Functional Description*. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: FOT-1 – Information Exchange Network – IEN: IEN Functional Requirements*. June 1997. <http://www.i95coalition.org>.
- I-95 Corridor Coalition, Reports and Projects, *Project Number: FOT-1 – Information Exchange Network – IEN: Requirements Report*. <http://www.i95coalition.org>.

- I-95 Corridor Coalition, Reports and Projects, *Project Number: FOT-1 – Information Exchange Network – IEN: System Architecture and Communications Network for the IEN*. <http://www.i95coalition.org>.
- The Institute of Electrical and Electronics Engineers, Inc., *Guide to the IEEE 1512™ Family of Standards.* 2004.
- The Institute of Electrical and Electronics Engineers, Inc., *IEEE Std. 1512-2000: IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers.* June 21, 2000.
- The Institute of Electrical and Electronics Engineers, Inc., *IEEE Std. 1512.1-2003: IEEE Standard for Traffic Incident Management Message Sets for Use by Emergency Management Centers.* May 9, 2003.
- The Institute of Electrical and Electronics Engineers, Inc., *IEEE Std. 1512.2-2004: IEEE Standard for Public Safety Traffic Incident Management Message Sets for Use by Emergency Management Centers*. November 29, 2004.
- The Institute of Electrical and Electronics Engineers, Inc., *IEEE Std. 1512.3-2002: IEEE Standard for Hazardous Material Incident Management Message Sets for Use by Emergency Management Centers*. October 15, 2002.
- Maine Department of Transportation, *Maine IS Technology Newsletter, Tri-State Rural Advanced Traveler Information System (TRIO)*. Volume IV, Issue 12. December 2001. <http://www.state.me.us/newsletter/december2001/trio.htm>.
- Maptuit Corporation, *South Florida Traffic.* 2005. <http://host.maptuit.com/fdot/?config=TrafficW.FDOT&aoi=0>.
- *SunGuide Florida's Intelligent Transportation System.* <http://www.sunguide.org/>.
- Maryland State Highway Administration, *CHART.* 2001. <http://www.chart.state.md.us/default.asp>.
- Massachusetts Turnpike Authority, *Traffic and Weather.* <http://www.massturnpike.com/>.
- Massachusetts Turnpike Authority, *Travel Services*. <http://www.masspike.com/travel/index.html >.
- New Jersey Turnpike Authority, *New Jersey Turnpike Roadway Conditions.* <http://www.state.nj.us/turnpike/nj-conditions.htm>.
- New York City Department of Transportation, *Advanced Traveler Information System.* <http://nyctmc.org/>.
- North Carolina Department of Transportation, *North Carolina Smartlink.* <http://www.ncsmartlink.org/cameras/>.
- North Carolina Department of Transportation, *Presentation: North Carolina's 511® System.*
- PB Farradyne, *Regional Architecture Web Software Functional Requirements*. January 14, 2005.
- PB Farradyne, *Regional Information Sharing*. <http://www.pbfi.com/products/Framework/smartNetcrop.pdf>.

- Pennsylvania Department of Transportation District 6, *Philadelphia Highways: Philadelphia Traffic Control Center.* March 14, 2005. <http://philadelphia.pahighways.com/philadelphiatcc.html>.
- Pennsylvania Department of Transportation, *Traveler Information.* 2001. <http://www.dot.state.pa.us/>.
- SmartRoute Systems, Inc., SmarTraveler. <http://www.smartraveler.com/>.
- Society of Automotive Engineers (SAE), *Advanced Traveler Information Systems Committee Project Scope.* 2005.
- Society of Automotive Engineers (SAE), *Surface Vehicle Standard.* November 1999.
- TRANSCOM. <http://www.xcm.org/index.html>.
- U.S. Department of Homeland Security, *Securing Our Homeland - U.S. Department of Homeland Security Strategic Plan.* 2004.
- Virginia Department of Transportation, *511® Virginia Evaluation.* January 2004.
- Virginia Department of Transportation, *511® Virginia Traffic and Travel Information.* 2005. <http://www.511virginia.org/>.
- Virginia Department of Transportation, *Programs: Smart Travel.* 2005. <http://www.virginiadot.org/infoservice/smart-default.asp>.
- Virginia Department of Transportation, *Travel Center.* 2005. <http://www.virginiadot.org/comtravel/default.asp>.