Concept of Operations

Regional Integrated Transportation Information System (RITIS)

Working Document

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PREFACE

This concept of operations (ConOps) outlines the high-level functional and technical requirements of the Regional Integrated Transportation Information System (RITIS), a data fusion and dissemination system for transportation-related data in the Washington, D.C. region. The ConOps is based on input from a wide variety of stakeholders, including traffic operations agencies, transit operators, public safety agencies, traffic information service providers, and archived data users. Input was obtained through a series of stakeholder meetings held in the summer and fall of 2006. A complete list of attendees for the stakeholder meetings can be found in Appednix D.

1 BACKGROUND

Washington, D.C. is one of the most congested regions in the United States. The most recent data (2003) from the Texas Transportation Institute[1] indicate that traffic congestion costs the region over $2.4 billion annually, including 145 million person-hours of time and 88 million gallons of gasoline. Nearly half of this congestion is due not to sheer traffic volume but to the effects of incidents such as crashes, disabled vehicles, and weather-related hazards. This congestion costs individual motorists time and money, reduces the region's economic competitiveness, and exacerbates air-quality problems by increasing vehicle idling time and emissions.

Several of the region's transportation agencies have implemented stand-alone incident and traffic management programs to mitigate the effects of incidents, improve emergency response, and manage congestion. Each agency operates its systems separately, using its own data collection and processing systems. However, conditions in one jurisdiction affect travel in others and sometimes throughout the entire region. Disruptions on one part of the network often have significant effects on one or more other jurisdictions on another part of the network. Such regional disturbances require a regional solution.

While there is nationwide interest in regional transit and traffic management, the need for a regional system in the Washington, D.C. metropolitan area was underscored by recent events. The most notable was 9/11, which highlighted the need for a regional evacuation plan. There have been other events that warranted better regional coordination, such as jurisdictional confusion over stopping a suicidal man from jumping off the Woodrow Wilson Bridge, and managing the resulting traffic in the area of the incident.

Currently, each Washington D.C. metropolitan area transportation agency maintains its own equipment and software for monitoring traffic and travel conditions and for making operational adjustments. Information sharing between transportation agencies is ad hoc and relies on personal relationships between staff from the various transportation operations centers. While this information-sharing technique has resulted in cross-jurisdictional and cross-modal coordination during large-scale events such as the annual Fourth of July celebration, it is not a timely, reliable, consistent mechanism for sharing operational data.

This need for regional management of Washington, D.C.'s transportation system is impetus for the Regional Integrated Transportation Information System (RITIS). RITIS is a data fusion and dissemination system that will compile transportation data from each participating agency, standardize it, and make it available to other participating agencies through each agency's existing transportation management systems. RITIS

[1]Texas Transportation Institute, *2005 Urban Mobility Report*, available at *http://mobility.tamu.edu/ums/*

will not collect data directly from field devices; rather, participating agencies will collect data from their field devices or enter information into their incident management system and make it available to RITIS. RITIS will also archive data for use in transportation-related studies and performance evaluations.

RITIS planning began in 2002 with a grant from the federal government issued to the Metropolitan Washington Council of Governments (MWCOG). The Center for Advanced Transportation Technology (CATT) Laboratory of the University of Maryland, College Park, began work on RITIS in 2006, and is the RITIS system developer. The following agencies will be the initial participants in RITIS, with others to join later:

- Maryland Department of Transportation (MDOT)
- Virginia Department of Transportation (VDOT)
- District of Columbia Department of Transportation (DDOT)
- Montgomery County, Maryland Traffic Management Center (MCTMC)
- Washington Metropolitan Area Transit Authority (WMATA)

In addition to the five participating agencies, other transportation agencies in the region will benefit from RITIS. First, RITIS information will be available to them through a read-only web interface. Furthermore, RITIS could provide the basis for a simple incident management system for these agencies. Each agency would require a user interface for viewing data from other participating agencies and for entering its own data. The new data would then be transmitted to RITIS, which would store and disseminate the information.

RITIS will not belong to any single agency. Rather, it will be managed collaboratively by the participating agencies. Concurrent with RITIS development, the Departments of Transportation of Virginia, Maryland, and the District of Columbia, along with the Washington Metropolitan Area Transit Authority and the Metropolitan Washington Council of Governments, are working to establish a coordinated program of transportation incident management, known as the Metropolitan Area Transportation Operations Coordination (MATOC). MATOC will provide coordination in the institutional, operational, systems, and public outreach areas. This consortium will eventually determine the organizational structure of RITIS management, operations, and maintenance.

1.1 Vision and Objectives

The purpose of this project is to improve transportation efficiency, safety, and security through the integration of existing transit and transportation management system data in Virginia, Maryland, and the District of Columbia into a regional transportation information system, RITIS. RITIS will emphasize data fusion and its relationship to data collection, regional transportation systems management, regional traveler information dissemination, and systems evaluation. It will enhance ongoing activities performed by individual agencies, companies, and the public by providing

each with real-time, regional transportation information in an electronic, standardized format.

By consolidating, disseminating, and archiving transportation-related data from various agencies in the Washington, D.C. area, RITIS will:

- provide improved information for a variety of purposes, including regional transportation management, traveler information, and emergency response
- provide regional data fusion to allow an overall view of the region's transportation network
- support and complement activities of participating agencies in data collection related to regional transportation systems
- support and complement transportation systems management efforts of the member jurisdictions for regional transportation operations
- support and complement traveler information and 511 activities related to regional traveler information
- support and complement the region's emergency preparedness activities
- provide the means to produce regional performance measures and access regional transportation data from a single location

1.2 RITIS Capabilities

RITIS has two primary capabilities: the exchange of real-time transportation-related information and the archiving of regional transportation-related data.

1.2.1 Real-time Information Exchange

The real-time component consists of collecting, filtering, standardizing, and disseminating information for use in incident and emergency management to provide a current, regional view of traffic and transit conditions. RITIS consolidated data will also be used by agencies and traveler information service providers. Each participating agency will maintain ownership and operation of its field devices for collecting data on traffic and transit conditions. Each agency will send information to RITIS, which will translate the disparate computer languages, referencing systems, and communications protocols into industry-wide standardized formats or formats recognizable by the agency's IT system. RITIS will then make these data available to each participating agency through the agency's own traffic and incident management systems. An important feature of RITIS is that, ultimately, it will not be a separate system or workstation that users will have to access; rather, each participating agency will integrate RITIS data back into its own system.

RITIS will greatly increase the regional situational awareness of operations staff from each agency by complementing the agency's own transportation management system and the direct interpersonal communications that take place among traffic management centers (TMC) from different jurisdictions. For example, a highway supervisor in Virginia might adjust the path of a detour route upon learning of an incident just over the border in Maryland. Using real-time data on traffic and transit

conditions in surrounding jurisdictions, each agency can adjust its transportation operations to account for conditions outside its jurisdiction and can monitor the impacts of its actions on the regional picture. During a regional emergency, transportation and public safety agencies can use RITIS's real-time operational data to adjust traffic or transit operating conditions to support emergency management efforts.

Traveler information is both a service to the public and an important component of incident management. Reducing travel demand along the affected transit or roadway section can decrease response time, the likelihood of secondary incidents, and incident clearance time. RITIS can be used as the primary database for a public traveler information system, allowing individual travelers to make informed decisions about when, where, and how to travel. Distribution of the information can take place through such channels as a public web site, 511 service, proprietary information service providers, radio and television broadcasts, and in-vehicle devices. RITIS will be able to push data directly to PDAs, cell phones, web sites, or other personal or vehicle-based devices, using user-defined filtering criteria such as incidents on a given roadway or within a particular city. The system will have the capability to filter sensitive information that should not be available publicly. Data will also be available to advanced traveler information service (ATIS) providers such as local media through a read-only web site or a direct data feed.

1.2.2 Archived Data

The RITIS system will archive all transportation-related operations data that is provided to RITIS, like incident locations, lane closures, responding agencies, and traffic detector data, which will be available for use in transportation studies and performance evaluations. Archived data can be used by agencies for quantitative analyses of system performance, proposed changes, and travel and air quality modeling. Researchers can use RITIS data to better understand travel conditions and behavior. It can also be used for longer-term planning for special events, evacuations, and emergencies, and especially for events of a regional scale that require cross-jurisdictional or cross-modal plans.

RITIS will also store and use static information about roadways and transit service. Examples of static information for roadways include number of lanes, speed limit, and location of variable message signs (VMS); examples for transit include schedules, routes, and stops. This information will be displayed graphically, allowing agencies and the public to see the physical characteristics of roadway links, which is especially important for incident management.

As a repository for consolidated transportation information from the area's largest traffic and transit operations agencies, archived RITIS data will be valuable for transportation studies and research. This data will be accessible through a web site equipped with online query and reporting tools.

1.3 Potential Data

Potential data to be compiled from agencies' systems includes:

- **Traffic volume and speed.** This information will be collected by agencies from roadway detectors and shared through RITIS.
- **Incident information.** This will consist of information entered by each agency into its own incident management system and shared through RITIS. Data could include incident location, type, severity, vehicles involved, and responders; lane closures; and messages on variable message signs (VMS). RITIS will also collect and distribute similar information on planned lane closures and special events.
- **Weather data.** RITIS will collect and distribute weather alerts and radar data from the National Weather Service (NWS). In addition, it will collect data on weather and pavement surface conditions that agencies gather from their roadway weather information systems (RWIS).
- **Device operational status.** RITIS will collect data on the operational status of roadway devices from each agency. These will include detectors, VMS, traffic signals, highway advisory radio (HAR), and cameras where available.
- **Managed lane status.** RITIS will share the status of high-occupancy vehicle (HOV), high-occupancy toll (HOT), and reversible lanes.
- **Surveillance video.** Through RITIS, agencies will be able to share live closed circuit television (CCTV) feeds. Each agency will be able to view cameras owned and operated by other participating agencies. Device control will not be shared.
- **Transit alerts.** Transit alerts sent out by WMATA and other transit providers (public and private) will be available through RITIS.
- **Automated vehicle locations.** Participating agencies will share vehicle location data for automated vehicle locator (AVL)-equipped vehicles, including buses, emergency response vehicles, and freeway service patrols.
- **Signal status.** Agencies that manage signals will share the operational status of each signal, such as operational, maintenance mode, flashing, or offline.
- **Signal timing plans.** Agencies will share signal timing plans and transmit real-time information on the current timing scheme where available.
- **Traveler information.** RITIS will record and compile messages that agencies relay through highway advisory radio (HAR), as well as alerts that agencies send out to mobile phones, PDAs or other personal and in-vehicle devices.
- **Computer-aided dispatch (CAD) information.** RITIS will compile appropriate transportation-related information from public safety computer-aided dispatch (CAD) systems.
- **Static, descriptive information.** RITIS will store and share information on roadway infrastructure and transit characteristics. For transit, this will include schedules, routes, and stops. For roadways, it will include information such as number of lanes, weight and height restrictions, speed limits, evacuation routes, and location of intelligent transportation system (ITS) devices.

1.4 Primary Users

RITIS's primary users will be **staff in the traffic and transit operations centers** of the participating agencies. The system will provide TMC personnel with situational awareness of traffic conditions and incidents in other jurisdictions and modes. Operations staff can then adjust their devices—for example, VMS and signal timing—to account for conditions in neighboring jurisdictions that affect their traffic operations.

Field staff from traffic and transit agencies will also use RITIS. Transit managers will find RITIS useful when deciding when and how to detour a bus based on incident information. Field staff from traffic operations agencies—such as freeway service patrols—can use RITIS to better respond to incidents. By accessing RITIS's web site or through data transmission to a PDA or in-vehicle device, service patrol staff can see traffic conditions around the incident. This situational awareness will help them to choose the best route to the incident and place the appropriate temporary traffic control devices to divert or warn travelers. RITIS will also be helpful in coordinating freeway service patrol response between jurisdictions for a major incident that requires more field personnel than a single agency can provide or when an incident occurs near jurisdictional boundaries. Field personnel on-scene at an incident can provide information about the status of the incident, including still photos, to their TMC, which can share the information through RITIS.

Public safety personnel and other emergency responders will use situational awareness gained from RITIS to help make decisions about response to an incident such as choosing the best route to the incident, determining the resources necessary at the incident site, and coordinating resources among jurisdictions and agencies. These personnel can also provide information for input into their own incident response system that can be shared through RITIS.

Information service providers such as local media, 511, and traveler information systems will have access to a central location for real-time transportation data. Local media will not have to communicate individually with each agency for information on roadway and transit conditions because they will be able to access RITIS information through its public web site or directly from RITIS data feeds. They can also receive alerts and information on system status pushed out by RITIS to PDAs or other mobile devices based on user-defined filtering criteria. RITIS information will also be provided to other companies that provide traveler information, such as General Motors' OnStar. These ATIS mechanisms will reduce the burden on each agency to provide traveler information.

Agency public affairs personnel will find RITIS useful in giving accurate, comprehensive information on transit, traffic, and incident conditions that cross modal and jurisdictional boundaries.

Senior managers and policy makers from transportation, transit, and public safety agencies will use real-time RITIS data to monitor their agency's incident response, especially for major incidents. Managers and political appointees are frequently called on to make important decisions such as how to divert traffic if a freeway is closed. They also might be the agency's primary point of contact with the media. Archived RITIS data can be used for after-incident debriefs to understand the incident, agency responses, and the impacts on traffic in their jurisdiction and in the region. RITIS data can also be used to generate information on transportation system performance, which will be helpful in determining the effectiveness of current transportation operations and in making decisions about future operational changes.

RITIS will become an important part of each agency's information technology (IT) system**. IT staff** from each agency will modify their agency's existing traffic and incident management systems to allow RITIS data into the system and to display the data on the agency's native system. Agency IT staff will also maintain the RITIS capability of their native system and make any necessary modifications resulting from changes in RITIS's functionalities.

The **traveling public** will be important consumers of RITIS information. They will be able to access traveler information through RITIS's public web site, transit station traveler information systems, mobile devices, and media.

RITIS data will be available for **archived data users** including researchers, transportation planners, other transportation agency staff, and consultants. Archived data will be used to conduct transportation-related studies, create travel demand and air quality models, and monitor roadway and program performance.

Table 1 provides a list of RITIS users in each user category. Appendix A contains a more detailed list of users and their roles in RITIS.

Table 1 RITIS Users

Operations Center Staff	Field Personnel
Traffic management centers	Freeway service patrols
Transit management centers	Transit operators
Commercial freight dispatch centers	Transit supervisors
Public Safety Staff	Construction crews
Emergency management agencies	Maintenance crews

Public safety operators and dispatchers	**Emergency Responders**
Traveler Information Providers	Law enforcement agencies
Agency traveler information personnel	Fire departments
Agency public affairs staff	Emergency medical services
Proprietary traveler information service providers	Hazardous materials management
Media	Tow truck companies
Archived Data Users	**Information Technology Staff**
Agency operations personnel	System developers
Researchers	System/database administrators
Planners	Agency information technology staff
Senior Managers and Policy Makers	**Travelers**
Agency operations managers	Private vehicle drivers and passengers
Agency senior managers	Transit riders
Elected and appointed officials	Commercial vehicle drivers

1.5 Capabilities Considered but Not Included

RITIS will not calculate and disseminate actual travel times, nor will it generate forecasts of travel times from models of past and present conditions. Project partners rejected this function because there are currently insufficient traffic detectors across the region to generate meaningful forecasts.

RITIS will also not enable an "instant message" capability to allow staff in operations centers and the field to communicate electronically in real time. This was not included because there would be "no assurance that the intended message recipient would read the message in a timely manner."

Surveillance video can be shared among agencies in the region (including those that are not connected to RITIS but that are authorized to access the operational web site). However, control of these devices will remain exclusively with the device owner. Shared control of cameras was rejected to avoid conflict among agencies in the real-time panning, tilting, and zooming of cameras.

RITIS will not directly provide dynamic routing for emergency response vehicles. This function was rejected because it is unlikely that any agency will have sufficient information to determine the most efficient route.

1.6 Potential Transportation Operations Policy Issues

By agreement of the sponsoring agencies, RITIS will be used as a tool to help agencies perform their functions, but it will not alter the lines of legal or operational responsibility for incident management, traffic management, or other aspects of transportation. Data collection from and maintenance of field devices will remain the responsibility of the participating agencies. RITIS will compile and distribute traffic and transit information, but it will not actively manage traffic or transportation operations and incidents independent of existing lines of authority.

RITIS will provide data to and extract data from multiple systems at multiple agencies. This will require review of information systems policies at the agency level to determine appropriate interface requirements and logistics. Agency firewalls will need to allow RITIS information to flow in and out while preventing system incursions.

One of the primary benefits of RITIS is that it will allow cross-agency and cross-modal coordination. Policies related to this coordination must be established—probably by MATOC—to avoid conflicting data and response, and to best manage incidents that cross jurisdictional and modal boundaries. Policies on data privacy and security will also need to be examined, as will the need to restrict safety-sensitive data such as that from CAD systems.

1.7 Potential System Operations Issues

Each agency's existing system will require some modification to view RITIS information. In addition, changes to data elements or native systems at the agency level might impact RITIS's data fusion scheme. Agency IT staff will need to work closely with RITIS developers to comply with RITIS architecture and to notify RITIS developers of changes to their agencies' IT systems.

Some participating agencies have requested data customization and filtering for RITIS data. When agencies request that they not receive all available data, limiting their data to, for example, specific types of incidents or incidents only in a given location, this might introduce a liability issue if agencies do not receive critical incident-related information.

Not all participating agencies have the ability to, or do not reliably geo-locate incidents and events. Therefore, a comprehensive regional map showing real-time status of transportation facilities or devices will require extra information processing to translate textual location descriptions to geographic information system (GIS)-based data. In some cases, such processing may be inaccurate or even impossible. Additionally, agencies without mapping capabilities that want to see RITIS incidents on a map will have to use the RITIS web interface.

It has not yet been determined how RITIS will be operated and maintained. In particular, RITIS users must decide how these activities will be funded, how

operations and maintenance (O&M) responsibilities will be shared, and how O&M decisions will be made. MATOC will help to determine long-term O&M funding.

2 CONCEPTS FOR THE PROPOSED RITIS SYSTEM

2.1 Description of the Proposed System

RITIS will leverage existing public agency data sources to provide a variety of information services to support traffic management operations, transit operations, incident management (including after-action evaluations), emergency response, emergency management, transportation planning, transportation research activities, and expansion of traveler information services. RITIS will exchange data across jurisdictions, modes, and disciplines at the local, state, and federal levels. The system will help agencies to identify incidents, facilitate the necessary cross-agency coordination, and provide situation updates. RITIS will compile, fuse, tailor, and distribute regional transportation data automatically around the clock and will operate identically for daily operations as well as during emergencies. The main RITIS functions are:

Compile Regional Transportation Data. RITIS will compile and disseminate data on transportation conditions in the region. For example, RITIS will provide data on: incidents, volume, speed, special events, emergency and planned lane and road closures, recommended detours, CCTV and device status, weather from RWIS, weather radar and alerts from NWS, VMS and HAR messages, AVL, transit schedules, bus routes, and transit service disruptions.

Process Regional Transportation Data. After collecting data from participating agencies' systems, RITIS will fuse it into regional transportation information. To complete the data exchange, the collected data is repackaged to conform to a format that the receiving systems recognize. This requires coordination between RITIS and the participating agencies that provide and receive data.

Standardized messages conforming to industry-wide standard protocols will be the key enabler of information exchange between regional systems. This allows the data from each agency to be processed through the RITIS gateway/bridge and translated from existing formats into standardized packets that can be transmitted over the Internet to all other participating agencies. Once it is received the data can be incorporated into the receiving agencies' operational systems. The data processing is automatic and transparent to the RITIS users.

Archive Data. The integration of external events into the RITIS system offers the ability to archive data from across the region into a single archived data management system. This system will support operations, planning, research and development, and performance measurement generation.

Distribute Data

- **Center-to-center (C2C) data exchange.** RITIS will facilitate real-time data exchange between TMCs. Once the data has been distributed to the operations systems of participating users, each agency will decide how to handle the information. ATIS providers such as local media and GM's OnStar could also be included in C2C data exchange.
- **Operational web sites.** The operational web site will allow the data being exchanged through RITIS to be viewed by transportation and public safety personnel from agencies that are not connected to RITIS. In addition, RITIS might provide a web site that allows staff from non-participating agencies to enter their own incident management information, which can then be shared through RITIS.
- **Region-wide traveler information web site.** The RITIS traveler information web site will provide the public and ATIS providers with consistent, region-wide traveler information.

2.2 Architecture

Three possible architectures were considered for the RITIS system: centralized, decentralized, and hybrid.

In a **centralized architecture**, one central database would be used to collect, store, and distribute all data in RITIS. This single database would have one or more backup databases at distinct physical locations, but these backup databases would not be leveraged to support performance improvements resulting from load and work distribution. They would be used only for system reliability in case of a failure of the main database.

In a **decentralized architecture**, each data provider (or agency) would be responsible for maintaining its own database in its own data format. While this eliminates the problem of a single point of failure, each data provider would be responsible for maintaining and administering its database for both real-time and archived applications and for translating its data to a format usable by all other data consumers. This architecture puts the burden of operations, maintenance, backup, and recovery on each agency. Additionally, the number of translation mechanisms increases exponentially as data providers join the network since every data provider must generate a unique data translator for every other data provider to enable seamless communications to every other agency's database. Operations and maintenance overhead for this architecture would be significantly higher than for the centralized architecture.

A **hybrid architecture** was chosen for RITIS. Duplicate databases will be deployed at one or more physical locations. A single translation layer is used to load the data into each of these databases. Consumer transactions can then be processed in parallel using all of the available databases. When a user requests a set of data, one piece of

data can come from a single database, or the transaction can be sped up by distributing the workload over several of the servers residing in one or more locations. This procedure is transparent to the consumer. Most importantly, however, is that failure of one of the databases does not affect the operation of RITIS in any way since all the other databases are redundant and used for load sharing.

The hybrid architecture has several advantages over the centralized and decentralized architectures:

- Distributed transactions run in parallel, increasing processing speed.
- Failure of one of the databases does not affect the rest of the system in any way.
- A single mechanism handles data translation and standardization for all providers and consumers, eliminating the need for a unique translation mechanism for each producer/consumer pair.
- Data redundancy improves system reliability.

 shows a high-level representation of the RITIS architecture. The RITIS architecture is consistent with the Washington, D.C. area's regional ITS architecture, as required by U.S. Department of Transportation regulations.[2] In addition, RITIS's elements will be compliant with industry-wide NTCIP standards.

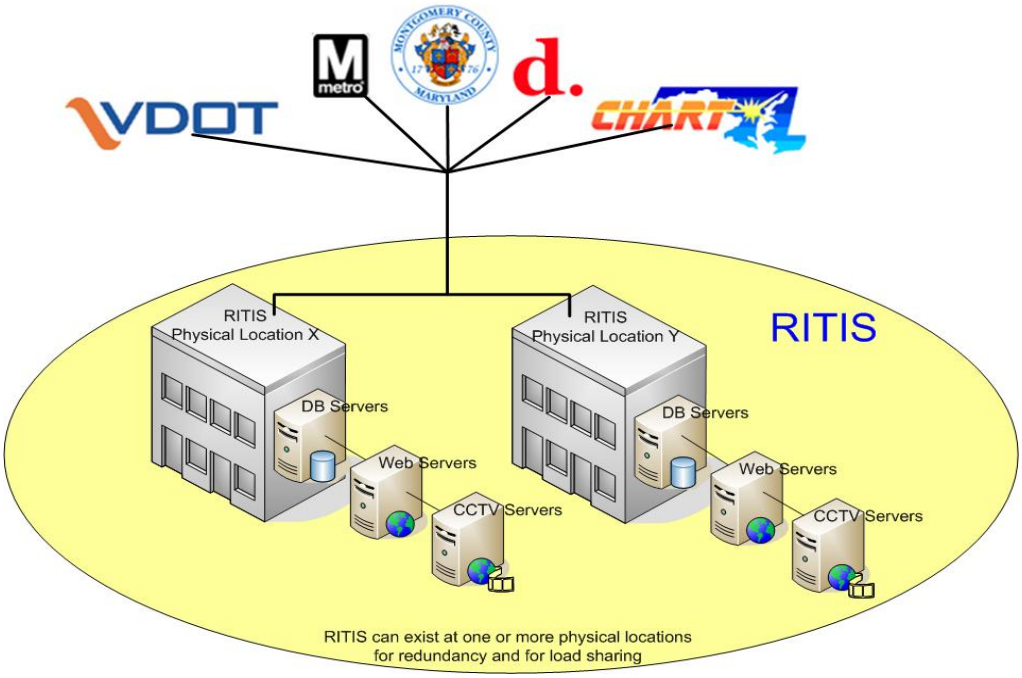


Figure 1: RITIS Centralized Distributed Architecture
Note: Additional, future agencies will be added as needed and appropriate.

[2]Federal Highway Administration. 23 CFR 940, available at *http://www.ops.fhwa.dot.gov/its_arch_imp/docs/20010108.pdf*
Federal Transit Administration. Federal Register, Vol. 66, No. 5, available at *http://www.ops.fhwa.dot.gov/its_arch_imp/docs/fta-pol.pdf*

2.3 Data

Within RITIS, all participating systems will be registered on the network as providers and/or users of particular classes of information. Any single system can be a data provider, a data consumer, or both. Table 2 shows the available data sources from each agency to gain an understanding of how RITIS can support agency decision-making, information sharing and coordination.

Table 2 Data Sources

	MDOT	VDOT	DDOT	MCTMC	WMATA
TMC	✓	✓	✓	✓	✓
VMS	✓	✓			
Systemized traffic signals	✓	✓	✓	✓	
CCTV	✓	✓	✓	✓	✓
Full motion video from aircraft				✓	
HAR	✓	✓		✓	
RWIS	✓	✓			
Ramp meters		✓			
Traffic sensors	✓	✓	✓	✓	
HOV gates		✓			
AVL-equipped buses					✓

Tables 3 and 4 show more detail about the data sources and which agencies are providers and consumers of each type of data. The tables demonstrate the breadth of available information and agencies that will benefit from accessing both static and real-time information. A graphical presentation of relevant traffic monitoring equipment data and other spatial data generated by RITIS partners will be standardized through a data transmission standard, data translation capabilities, and a common or harmonized spatial referencing capability.

Ultimately, RITIS will fulfill all the data sharing shown. However, because of budget and other constraints, RITIS will not be able to manage all available information from all participating RITIS partners in the initial system deployment. RITIS Version 1 will focus on a subset of critical data. As agency needs and capabilities change, the types of information provided to and distributed by RITIS will expand. Initially, RITIS will include data from highway and transit. In the future RITIS could be expanded to include all major arterial streets and other non-highway modes such as rail.

Table 3 Data Production

⊙ Agency produces this data for its own jurisdiction and would like to receive it from other agencies, where available

● Agency does not produce this data for its own jurisdiction but would like to receive it from other jurisdictions, where available

◇ Agency already receives this data from another source, and may or may not decide to switch to RITIS for this information

Category	Data Item	DDOT	MDOT-CHART	VDOT-NOVA	Montgomery County	WMATA Bus	WMATA Rail	911 Center	Local Police	State Police	Fire	Emergency Management	Media	Private ISP	Public
Video and Images	CCTV	⊙	⊙	⊙	⊙	⊙	⊙		●	●	●	●	⊙	●	●
	First-responder on-scene still images	●	●	●	●	●	●		●	●	●	●	●	●	●
	Aerial video from aircraft	●	●	●	⊙	●	●		⊙	⊙	●	⊙	⊙	●	●
Construction and Maintenance	Planned lane or road closures	⊙	⊙	⊙	⊙	⊙	⊙		●	●	●	●	●	●	●
	Emergency road or lane closures	⊙	⊙	⊙	⊙	⊙	⊙		●	●	●	●	●	●	●
	Construction detour plans	⊙	⊙	⊙	⊙	⊙	⊙		●	●	●	●	●	●	●
	Planned maintenance	⊙	⊙	⊙	⊙	⊙	⊙		●	●	●	●	●	●	●
	Emergency maintenance	⊙	⊙	⊙	⊙	⊙	⊙		●	●	●	●	●	●	●
Traffic Control	VMS status and message	⊙	⊙	⊙	⊙	⊙			●	●		●	●	●	●
	HAR status and message	⊙	⊙	⊙	⊙	⊙			●	●		●	●	●	●
	Signal status	⊙	●	⊙	⊙	⊙			●	●		●	●	●	●
	Traffic signal timing plans	⊙	●	⊙	⊙	⊙									
Traffic Flow Data	Volume	⊙	⊙	⊙	⊙	⊙									
	Speed	⊙	⊙	⊙	⊙	⊙			●	●	●	●	●	●	●
	Lane occupancy	⊙	⊙	⊙	⊙	⊙									
	Vehicle classification	⊙	●	⊙	⊙	⊙			●	●		●		●	
	Travel time	⊙	●	⊙	⊙	⊙			●	●	●	●	●	●	●
	AVL	⊙	⊙	⊙	⊙	⊙	⊙					●			
	HOV/toll/drawbridge status	⊙	⊙	⊙	●	●			●	●		●	●	●	●
Incident Management	Incident information	⊙	⊙	⊙	⊙	⊙	⊙		●	●	●	●	●	●	●
	CAD incident information	●	●	●	●	●	●		⊙	⊙	⊙	⊙			
	Alternate routing	●	●	⊙	●	●			●	●	●	●	●	●	●
Events	Special event schedule	●	⊙	⊙	●	●	●		●	●	●	●	●	●	●
	Traffic control plans	●	⊙	⊙	●	●	●		●	●	●	●	●	●	●
Road Weather Conditions	Pavement condition (wet, icy, snow-covered, etc.)	⊙	⊙	⊙	⊙	⊙			●	●	●	●	●	●	●
	Roadside weather	⊙	⊙	⊙	⊙	⊙			●	●	●	●	●	●	●

Category	Data Item	DDOT	MDOT-CHART	VDOT-NOVA	Montgomery County	WMATA Bus	WMATA Rail	911 Center	Local Police	State Police	Fire	Emergency Management	Media	Private ISP	Public
Weather	Live radar	●	⊙	●	●	●	●		●	●	●	●	◇	◇	◇
	NWS alerts	◇	◇	◇	◇	◇	◇		◇	◇	◇	◇	◇	◇	◇
Transit	AVL/probe data	⊙	⊙	●	⊙	⊙	⊙					●			
	Service disruption data	⊙	⊙	●	⊙	⊙	⊙					●	●	●	●
	Line or station closure data	⊙	⊙	●	⊙	⊙	⊙		●			●	●	●	●
	Transit incident	⊙	⊙	●	⊙	⊙	⊙		●	●	●	●	●	●	●
Emergency Alerts	Department of Homeland Security alert	◇	◇	◇	◇	◇	◇		◇	◇	◇	◇	◇	◇	◇
	Emergency Alert Broadcasting System	◇	◇	◇	◇	◇	◇		◇	◇	◇	◇	◇	◇	◇
	Amber alerts	◇	◇	◇	◇	◇	◇		◇	◇	◇	◇	◇	◇	◇
	Emergency management agency data	●	●	●	●	●	●		⊙	⊙	●	⊙	●	●	
Documents	Evacuation plans	◇	◇	⊙	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇	◇
System Static Data/GIS	Location of roadway cameras, detectors, VMS, etc.	⊙	⊙	⊙	⊙	⊙	⊙					●	●	●	●
Archived Data		●	⊙	⊙	●	●	●		●	●	●	●	●	●	●

Table 4 Data Consumption

● Agency will provide this data to RITIS
⊙ To be determined

Category	Data Item	DDOT	MDOT-CHART	VDOT	Montgomery County	WMATA Bus	WMATA Rail	911 Center	Local Police	State Police	Fire	Emergency Management	Media	Private ISP	Public
Video and Images	CCTV	●	●	●	●	●	●								
	First-responder on-scene still images	●	⊙	●	●				●	●	●	●			
	Aerial video from aircraft				●				●	●	●	●	●		
Construction and Maintenance	Planned lane and road closures	●	●	●	●										
	Emergency road and lane closures	●	●	●	●				●	●	●	●			
	Construction detour plans	●	●	●	●	●			●	●	●	●			
	Planned maintenance	●	●	●	●	●	●								

Category	Data Item	DDOT	MDOT-CHART	VDOT	Montgomery County	WMATA Bus	WMATA Rail	911 Center	Local Police	State Police	Fire	Emergency Management	Media	Private ISP	Public
	Emergency maintenance	●	●	●	●	●	●								
Traffic Control	VMS status and message	●	●	●	●										
	HAR status and message		●	●	●										
	Signal status	●	●	●	●										
	Traffic signal timing plans	●	●	●	●										
Traffic Flow Data	Volume	●	●	●	●										
	Speed	●	●	●	●										
	Lane occupancy	●	●	●	●										
	Vehicle classification	●	●	●	●										
	Travel time		⊙	⊙			●							⊙	
	AVL	●	●	●	●										
	HOV/toll/drawbridge status	●	●	●											
Incident Management	Incident information	●	●	●	⊙							⊙	⊙		⊙
	CAD incident information			⊙				⊙	⊙	⊙	⊙	⊙		⊙	
	Alternate routing	●	●	●	●	●			●	●					
Events	Special event schedule	●	●	●	●	●	●		●	●		●	●		
	Event traffic control plans	●	●	●	●				●	●		●			
Road Weather Conditions	Pavement condition (wet, icy, snow-covered, etc.)	●	●	●	●	●									
	Roadside weather	●	●	●	●	●									
Weather	Live radar														
	NWS alerts														
Transit	AVL/probe data		●	●	●	●	●								
	Service disruption data		●		●	●	●								
	Line or station closure data		●		●	●	●								
	Transit incident		●		●	●	●								
Emergency Alerts	Department of Homeland Security alert														
	Emergency Alert Broadcasting System														
	Amber alerts								●	●		●			
	Emergency management agency data											●			
Documents	Evacuation plans	●	●	●	●	●	●		●	●		●			

Category	Data Item	DDOT	MDOT-CHART	VDOT	Montgomery County	WMATA Bus	WMATA Rail	911 Center	Local Police	State Police	Fire	Emergency Management	Media	Private ISP	Public
System Static Data/GIS	Location of roadway cameras, detectors, VMS, etc.	●	●	●	●	●	●								
Archived Data		⊙	●	⊙	⊙	⊙	⊙								

2.3.1 Data Exchange

RITIS will automatically collect and distribute transportation network status data through direct or indirect interfaces with regional traffic monitoring systems. For RITIS to operate successfully, each interfacing system will have applications to detect changes in specified system data and will send updated data to RITIS in prescribed formats.

RITIS requires a high degree of center-to-center information sharing, integration, and coordination. Participating agencies need to see information from anywhere within the region as if the information came from that agency's own system, without the need for human intervention to transfer data from one system to the other. **Figure 2** shows an overview of RITIS data exchange.

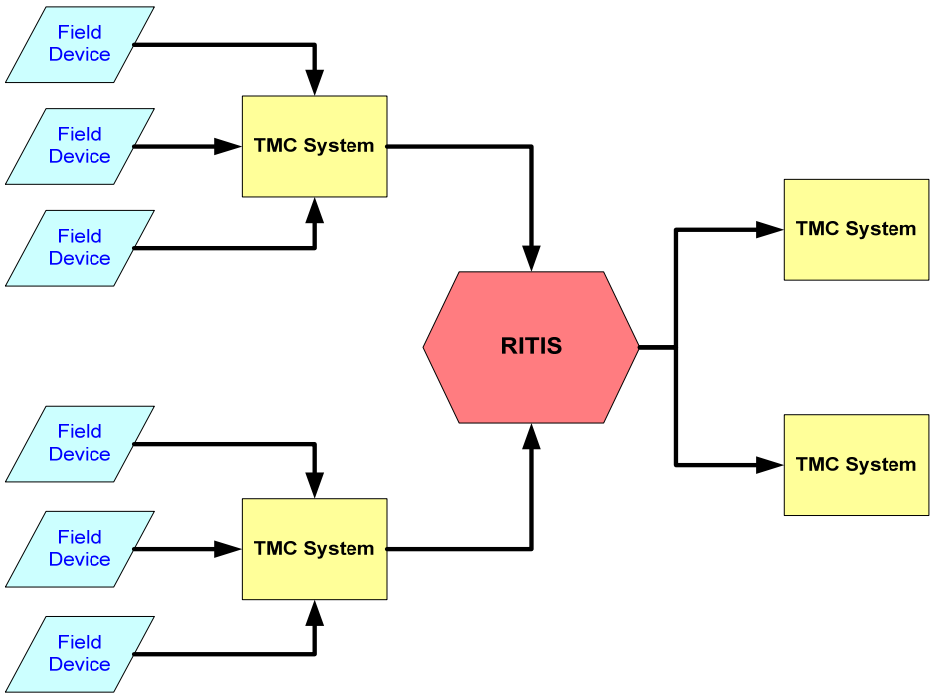


Figure 2: C2C Data Exchange

Table 5 shows the transportation functions supported by data within RITIS, the priority of the data to users, and the anticipated data access requirements.

Table 5 RITIS Data and Transportation Functions

	Transportation Management					Incident Management						Priority			User Access			
	Situational awareness	Traffic monitoring	Traffic management	Construction management	Fleet management	Incident detection	Incident verification	Emergency response	TM Response	Recovery	Emergency management	Phase 1	Later Phase	Excluded near-term	Direct operational user	Web operational user	Web public user	Archived data user
Real-Time Traffic Conditions Data																		
CCTV and aerial video	●	●	●			●	●	●			●	●			●	●	●	
On-scene still pictures and video	●							●				●			●	●		
Road sensor data	●	●	●			●					●	●			●	●	●	●
Automated incident detection alerts	●	●	●			●							●		●	●	●	●
Roadway surface condition data	●							●					●		●	●	●	●
Weather data	●											●			●	●	●	●
Planned lane closure data	●		●	●			●					●			●	●	●	●
Traffic signal status	●											●			●	●		●
Special events information	●		●				●					●			●	●	●	●
Incident Data																		
Data entered by TMC	●	●	●				●	●	●	●	●	●			●	●	●	●
Data entered on-scene	●	●	●			●	●	●	●	●		●			●	●	●	●
Traveler information	●	●				●						●			●	●	●	●
CAD data						●		●			●	●			●	●		●
AVL Data From:																		
Roadway service patrols					●		●	●			●		●		●	●		●
Emergency vehicles					●		●	●			●		●		●	●		●
Bus					●						●		●		●	●		●
Train					●						●	●			●	●		●
Tow operators					●			●		●	●		●		●	●		●
Snow plow operators			●		●						●		●		●	●		●
DOT/Department of public works/transit supervisors					●						●		●		●	●		●
Probe vehicles		●											●		●	●		●
Equipment Inventory Information																		
Inventory list														●	●	●		●
Equipment storage locations														●	●	●		●
GIS Data																		
Roadway geometry	●											●			●	●		●
Bridges, tunnels, highway-rail grade crossings	●											●						●

Transit stations, stops, routes, schedules	●											●					●	●
ITS device location, owner, coverage area	●	●	●			●	●	●	●	●	●	●			●	●	●	●
Freeway incident traffic management routes											●	●			●	●	●	●
Evacuation routes											●	●			●	●	●	●
Documents																		
Points-of-contact list												●			●	●		
FITM plans								●			●	●			●	●		●
Response plans								●			●	●			●	●		●
System documentation												●			●	●		●
Data Queries and Reports																		
Archived data												●						●

The C2C environment is operationally diverse. Multiple systems serving multiple functions, or even systems with the same function, do not operate identically. This diversity requires that RITIS employ a flexible approach to the required content of data exchanges as well as a rigorous definition of that data.

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 can be used by all providers (or at least a format that RITIS can translate). RITIS follows XML, NTCIP, traffic management data dictionary, and other industry standards. RITIS will provide translation back and forth between existing systems and NTCIP standards. MATOC will work to develop regional incident naming and classification standards. Agreement on data standards will allow data to be placed in its proper location in a message rather than in the narrative descriptive portion of the message. This will greatly enhance the system usability, and allow for ease of data sorting and filtering.

RITIS will 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 or java messaging protocols. If participating agencies deem it advantageous, the services could be implemented in full SOAP-based Web services.

2.3.2 Data Fusion and Processing

During the design phase, an inventory of all available data sources will be made to determine the desired data precision and reliability and the best data adjustment methods to minimize distortion and maximize the usefulness of the substituted data. The selected method(s) will be internally consistent, efficient, traceable, and objective. To ensure data quality, RITIS will perform data quality assessments, data imputations, and abnormality checks. The system will be able to identify the data source. Every data element will have a time and date stamp. Figure 3 shows the recommended approach to processing data sources automatically.

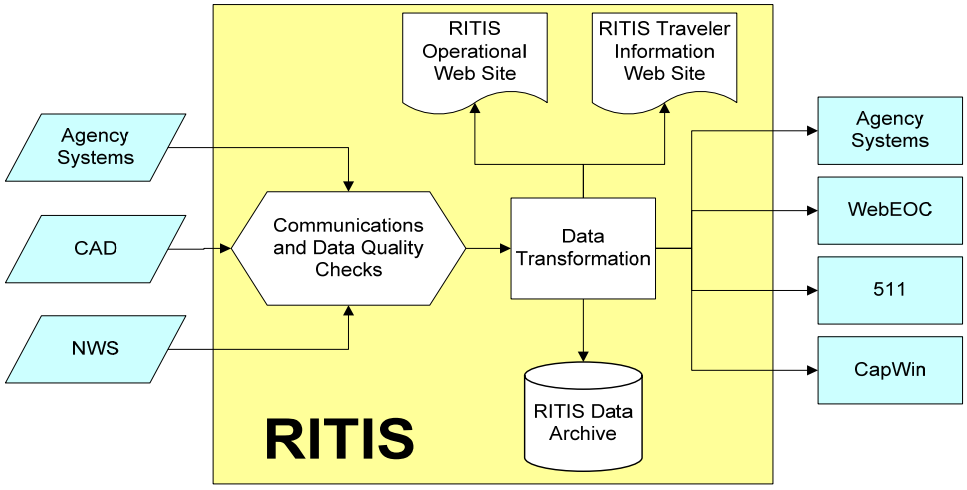


Figure 3: Figure 3 RITIS Automated Data Processing

RITIS will pull data from agency systems in a variety of ways, depending on the design of each agency's systems. After collecting the information, RITIS will prepare it to be distributed in both standard and custom formats.

2.3.3 Data Dissemination

After processing and formatting the data, RITIS will broadcast the data to each participating agency through a publish/subscribe system. This system allows agencies to "subscribe" to particular data of interest to them. RITIS then "publishes" the requested data as it becomes available.

To ensure that TMCs receive only data that they can use and to minimize the volume of data transferred, RITIS will have a mechanism for recording TMC data preferences. Each receiving agency will decide which data to accept. RITIS will be able to filter data by selected characteristics or combinations of characteristics available in the system such as device type, geographic location, and incident severity. Figure 4 shows a sample data selection profile.

RITIS Data Selection Profile

Center	VDOT
Station/User	Monitoring Station 1

Jurisdiction	Incident	Closings	Traffic	CCTV	Signal	Road Condition	VMS	HOV	Rail Disruption	Bus Disruption	AVL
DDOT	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙			⊙
VDOT	○	○	○	○	○	○	○	○			
MDOT	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙			
WMATA									⊙	⊙	⊙
Montgomery County	⊙	⊙	⊙	○	⊙					⊙	⊙
City of Falls Church	⊙	○	○		○						

Unavailable

National Weather Service	
Radar	⊙
Weather Alerts	⊙
CAD	
Montgomery County	⊙
Fairfax County	○

Figure 4: Sample Data Selection Profile

RITIS will have a reliable message component that ensures that centers receive all data that it sends. It will resend data if an error occurs. RITIS will evaluate the quality of exchanged data and will reconcile it as required. Each agency receiving RITIS data will establish its own means to receive and process it into its native system. Duplicate entries will be minimized by methods such as not sending data to originators, allowing for incident grouping, and maximizing transfer of discrete data elements versus narrative text.

RITIS will provide a standards-based messaging bus to facilitate communication between RITIS, participating agencies, and interested third parties. Information transmitted on the messaging bus will be sent as highly structured, standard XML appropriate for software parsing. The messaging bus will allow systems integrators to incorporate real-time RITIS data and information into individual TMC software packages and data collection tools. The structured data also lends itself to feeding information service providers who will repackage it to supply 511, subscription traveler information services, and in-car navigation devices.

Real-time Really Simple Syndication (RSS) data feeds will take live traffic and incident data from the RITIS databases and distribute it to third-party software on desktops and mobile devices. Other live data feeds include NWS Doppler radar and weather advisories. Live feeds can also be made available to other organizations through a subscription service.

RITIS will have the capability to alert users about anomalous conditions in traffic or transit movement based on user-defined criteria. Alerts, which can be set up on the RITIS web site, will be sent to agency field staff and travelers who request the

information. RITIS will provide easy integration of data services through Internet protocol for flexible delivery through text alerts, e-mails, web sites, and cell phones.

2.3.4 Data Quality and Integrity

Field hardware and software failures are common. In some cases, equipment redundancy provides sufficient information to cover gaps in missing data. In other cases, agency systems can detect bad data. RITIS will perform regimented data quality checks on select data to detect and attempt to repair data losses. Where checks are not or cannot be made, RITIS will document the handling of the data so that users are fully aware of the nature of the data.

Data quality performance measures that will be established include:

Completeness: Reported as percent complete, this measure compares the amount of data actually available for analysis with the amount that should be available based on data sampling rates and active sensor configurations.

Validity: Reported as percent valid data, this measure reports the percent of data that passes acceptance criteria such as valid value checks based on traffic flow properties.

Coverage: Reported as percent coverage, this measure describes the degree to which a sample accurately represents the whole that is being assessed. Percent coverage is reported for roadway mileage and vehicle-miles of travel. For example, a city may have 25 percent of its freeways instrumented with sensors. These same sensors might measure 30 percent of the freeway vehicle-miles of travel.

2.4 Web Sites

For most applications in participating agencies, RITIS data will be available through the agency's native systems. However, RITIS will maintain web sites to provide data to agencies not capable of accessing RITIS data in this manner. The web sites will also provide traveler information to the public and traveler information service providers and facilitate the use of archived data. This will require three separate web sites: an uncensored, protected version providing real-time information for transportation and public safety agencies; a censored, freely available, real-time version with sensitive information redacted for traveler information; and an archived data user version. Table 5 shows the features of each of the three web sites.

Table 6 RITIS Web Site Features

Feature	Operations	ATIS*	ADUS*
Camera video feeds	✓	✓	●
Incidents	✓	✓	✓
CAD information	✓	●	✓
Planned and emergency closures	✓	✓	✓
Special events	✓	✓	✓
Traffic conditions	✓	✓	✓
Weather alerts	✓	✓	✓
Weather radar	✓	✓	●
Static system data	✓	✓	✓
E-mail alerts	✓	✓	●
Feed Subscriptions	✓	✓	●
Allow data entry	✓	●	●

✱ Personally identifiable and security-related data redacted
✓ Yes
● No

Web site users will be able to filter and sort data according to their needs. Map-based options will also be available. For spatial selections and data display, stick maps of the freeway/arterial/rail system will be used. At different zoom levels, users will be able to select entire corridors, predefined road segments, or specific areas of interest. Simple parameter checks will be made to ensure that the user does not request a query or service that would take an excessive amount of time to process. Data will be processed in the web server as needed to reduce the amount of raw data sent over the HTTP channel.

2.4.1 Operations Web Site

The RITIS operations web site will allow personnel working outside of a TMC and staff from agencies that have not yet reintegrated RITIS data into their systems to view RITIS data. The web site will provide real-time, uncensored data, available only to authorized personnel. It will complement agencies' native systems by providing enhanced data display capabilities. The operational web site might allow data entry for agencies that do not have an incident management system, allowing them to view not only data from other agencies but also to enter, store, and share their data through RITIS.

2.4.2 Traveler Information Web Site

The RITIS traveler information web site will provide access to real-time, region-wide traveler information for the public, commercial vehicle operators, and traveler information service providers. Users of this web site will be able to search for information of particular interest to them, such as by corridor or jurisdiction. This web site will also be able to push user-defined traveler information to an assortment of remote devices such as cell phones, PDAs, and pagers. Data available on the RITIS public web site will be culled to remove sensitive information such as security-related

data and data that could be used to identify individual travelers. Figure 5 shows a typical graphics display from the RITIS operational and ATIS web sites.

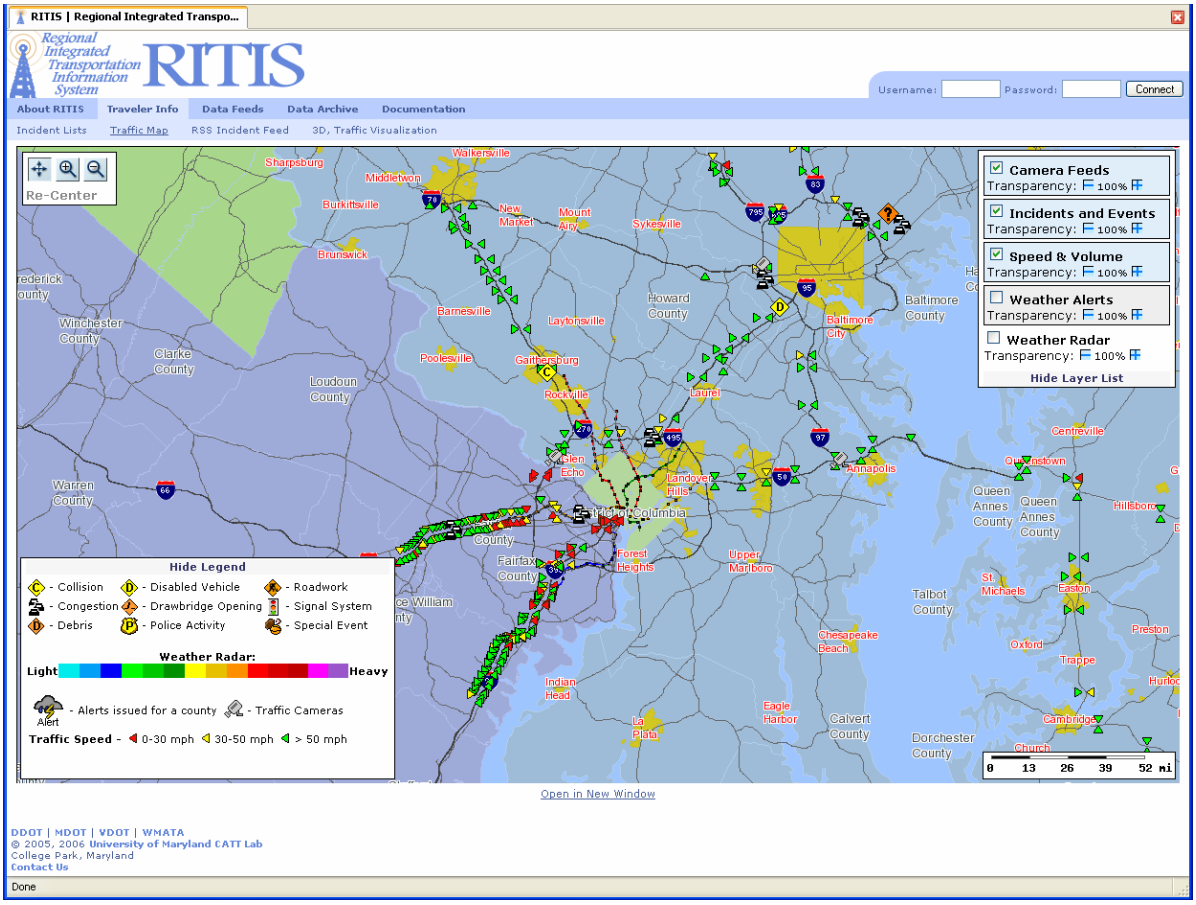


Figure 5 RITIS Graphical Display

2.4.3 Archived Data User Web Site

RITIS will provide a web site for accessing archived traffic and incident data. The web interface will provide searching and filtering capabilities, and users will be able to download data. The site will require passwords and permission levels that will govern what type of information a particular user will be able to access. Sensitive information will be removed from the data available on this web site.

2.5 System Interface

Participating agencies will continue to use their native transportation management systems. Data input into their systems might be shared with RITIS through the following configurations:

- modifying agency server software to enable data transmission to RITIS through the Internet

- using a stand-alone software package that eavesdrops on the agency network to glean information to be shared with the RITIS community
- using agency software to put shared data into the agency database and using a RITIS-related software package to read it and place it on the Internet for delivery to RITIS.

Because each agency uses a different traffic and incident management system, not all systems will be able to display all data available through RITIS. To view all available data, agencies will have to change their system capabilities or view the data on RITIS's operational web site.

2.6 Data Archiving

RITIS will automatically archive ITS-generated data and other allied data that influence the performance of the transportation system and the TMCs. The archived data will be available through a web-accessible repository of data exchanged through the RITIS system.

Archived data will serve as a rich source for both traditional and innovative regional transportation analyses and as a valuable record of decisions made and actions taken for incidents and other scenarios in the region. This function will allow users to better use the system and respond to or manage future transportation scenarios. Additional archived data uses might be transportation planning, transportation system performance monitoring, accident prediction modeling, incident detection, roadway impacts, construction impacts, air quality analyses, transit management, and emergency planning. The RITIS archived data user service (ADUS) web site will provide users with a cost effective, on-demand, one-stop shop for multi-agency, multi-disciplinary, multi-jurisdictional data continuously accumulated from sources across the region. All RITIS data except CCTV video and weather radar data will become part of the data archive. Data retention periods have not yet been established. Archived data may also be used operationally. Automated alerts can be established to inform users of network conditions that deviate from the norm, indicating a possible incident.

The RITIS archiving function will be developed as a centralized function to be funded and controlled regionally while being operated and maintained by the University of Maryland, which currently maintains nearly five years of historical freeway traffic data for the region. In addition, RITIS will provide the needed digital maps of the region. The RITIS ADUS site will provide users with a cost effective, on-demand, one-stop shop for region-wide data accumulated continuously from agency sources.

RITIS will provide a comprehensive data archive and retrieval service, including online access to data catalogues and other information. The RITIS archive will record data attributes, sources, and date and time of publication.

The RITIS archive function receives, processes, and distributes datasets to the region's transportation operations and research community for secondary analysis (see Figure 6). Where applicable and possible, collected data will be checked for quality and imputed as necessary. The RITIS archived toolset will allow users to perform a variety of canned and ad hoc queries and will return data to the user in a variety of media and formats such as *.txt files and Excel spreadsheets. Archived products will be available for delivery from the RITIS ADUS web site, through an FTP site, or through portable media such as DVDs.

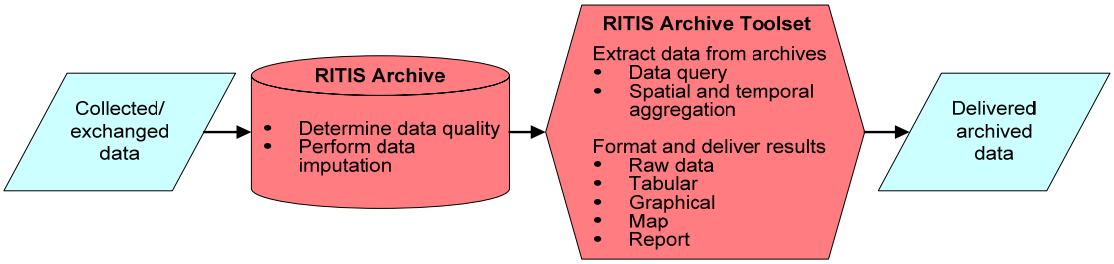


Figure 6: RITIS Archive Functions

Archived data that has been scrubbed of sensitive material will be made available publicly. However, an archive data policy will be created, a short user registration process will exist, and users will be asked to indicate their acceptance of the terms and conditions under which the data is provided. RITIS will track usage of archive services.

RITIS will provide an archived data graphical interface for data querying and mining for researchers, decision-makers, and others. This function will output raw data or aggregates of the raw data, at the user-requested temporal and spatial levels of aggregation.

Temporal aggregation. RITIS will allow for selection of date range, day of week/weekday/weekend, time of day range, and data aggregation time period (such as five-minute or 15-minute averages).

Spatial aggregation. RITIS will allow for aggregation by detector level (lane by lane), station level (all lanes aggregated), node, link, and direction of travel.

Performance measurement toolset and reporting. RITIS will allow ad-hoc and predetermined statistical reports to form region-wide or agency-specific summaries, including:

- three-dimensional (3D) data query and spatial/temporal graphing visualization tools; 3D traffic data graphing allows users to query the RITIS incident databases to graph incident statistics, derive performance measures, and create timelines of individual incidents.
- detector health visualization tool

- data extraction and query tools which will enable users to query for specific data and extract that data for analysis
- predetermined reports on regional transportation statistics the ability for users to generate their own ad hoc queries
- real-time and archived incident information and status

Data Archiving. Future stages of RITIS development will include study of different data archive mechanisms. The selection of the archive format will be based on the availability of customizable features and data characteristics. Other issues to be addressed are:

- Data quality: RITIS will analyze and detect erroneous traffic data coming into the system and flag it as such within the archive.
- Meta-data: RITIS will provide a description of the data being archived. The meta-data structure has not yet been determined.

2.7 Security

The use of state-of-the-art security solutions, including encryption, firewalls, tiered access protection, and attack detection software, will be essential to a successful deployment of RITIS. Security will be provided for access to the operational and public web sites and applied to data transmissions into and out of RITIS. The operational and ADUS web sites will require a username and password for access. The operational side of RITIS will be limited to secure access by public agencies. RITIS will register, authenticate, and authorize users and services.

Participating agencies should be able to control and monitor access to information by specific individuals and groups of users. RITIS will include the ability for an agency-selected administrator to manage user accounts and permissions. RITIS will also ensure the security of data being sent between centers though an authentication process.

2.8 System Performance

Standards and requirements will be developed that identify and define performance parameters for system speed, accuracy, dependability, availability, robustness of connection establishment, information transfer, and connection disengagement. There will also be measures for information accuracy, timeliness, usefulness, and reliability. Measurement techniques will be defined for these performance parameters.

The RITIS platform includes duplicate hardware and software configurations for backing up components in case of failure. RITIS will allow seamless switching to the alternate system in the event of failure of the primary system. Archived data will be

stored separately from the operational system and will be backed up to tape or other media on a regular basis. Backup data will be stored offsite.

2.9 External Interfaces

RITIS will have many external interfaces including, but not limited to:

- each participating TMC's traffic, incident, or transit management system
- third party traveler information service providers
- CapWIN
- WebEOC
- 511 services
- EMMA
- Media

2.10 Support Environment

RITIS functions will be largely invisible to operations centers in participating agencies since they will see RITIS data through their native system. Therefore, most users will require very little training on RITIS. The RITIS developers will provide instructions on how to connect to the RITIS system and request data. Documentation will also be provided on how to submit data to RITIS. The system developers will write operations manuals for each web site. In addition, they will document the RITIS source code to support future maintenance.

Once the first full version of RITIS is fully tested and operational, the project will enter a phase that includes concurrent development of the next release and a routine O&M. O&M expenses will include hardware and software costs and the professional services expenditures needed to properly maintain any software application. Included in these recurring software maintenance costs are annual maintenance contracts, upgrade cycle costs, and costs related to "bug" fixes and application troubleshooting. Hardware costs include maintenance contracts and hardware upgrades to ensure that the RITIS network infrastructure has sufficient capacity to minimize network latency as the user base expands and network message traffic increases.

The system might need to scale for the number of simultaneous users, the number of sensors supported, and the amount of data that can be archived. The ease of incorporating new agencies into the system should be considered during RITIS development. In addition, as telecommunications technologies advance, RITIS might have to be adapted to them. The RITIS network should be designed to be technology-independent and not require an overlay for each new advance.

RITIS is unusual because no single agency can claim ownership of the project and, by extension, pay any of the recurring costs. Participating agencies must commit to working collaboratively through MATOC to ensure that RITIS is properly operated and maintained.

The value to participating agencies depends in large part on changes made to each agency's existing transportation management system to accommodate RITIS. RITIS will provide a structure for the exchange of event information but does not itself provide integration between systems. Subscribing agencies will be responsible for changing or upgrading its system complying with RITIS requirements and standards before publishing or receiving information through RITIS. Each agency will be responsible for to comply with RITIS standards and requirements. All participating agencies will publish and receive data in NTCIP-compliant formats.

As the systems evolve, participating agencies will need IT personnel to manage changes in translation and interface software at the point of connection to their operating systems. Because of the complex nature of translating information tailored to each individual participating system, RITIS and participating agencies must ensure that configuration changes are carefully managed. This will require, at a minimum, documentation of each system's configuration at the time of its initial interface with RITIS. It will also require clearly defined policies and procedures for consulting with RITIS developers and maintainers to ensure that subsequent changes to an agency's native system(s) will not preclude RITIS participation.

Apart from possible outsourcing roles for data archiving, data processing, and centralized system maintenance, it is not expected that RITIS will require significant ongoing support from personnel within each agency. System interface modifications, data exchange testing, troubleshooting, and other technical support may be required of agency IT staff during system implementation and subsequent upgrades.

2.11 Operational Environment

RITIS will have a limited impact on agency-specific operational environments. The system developers are committed to providing data in many formats and through several protocols to accommodate the unique capabilities of each interfacing system. The extent of changes in agencies' existing systems depends on the specific interfacing system and on their level of compliance with RITIS data standards. RITIS will flag suspected conflicting information in the system and send warning messages as appropriate.

RITIS will expedite broadcasting information to secondary agencies that are normally not contacted under current procedures. However, it will not replace the personal communication currently in place for inter-agency coordination. Video sharing will help emergency responders to confirm an incident and to begin organizing a response before the first emergency vehicle arrives at the scene. Responders will be able to use video feeds to determine the best route for reaching a crash without being stuck in traffic. The RITIS implementation period is anticipated to make an additional impact on agency operations and staffing including training personnel and the development of customized screens for the system operators.

Operational procedures may differ between centers, requiring additional training, documentation, and conflict resolution procedures. Workloads might change and personnel might shift to monitor region-wide activities. Since the future state of some interfacing systems is unclear at this time, it is difficult to determine how individual systems and users will handle conflicting information. Procedures for resolving conflicts will need to be established by MATOC.

APPENDIX A. USER CLASS INTERACTIONS WITH RITIS

Table A-1 User Class Interactions with RITIS

User Class	Agencies/Organizations	Positions	Interactions with RITIS
Operations Personnel			
TMC operators	▪ DDOT ▪ VDOT ▪ MDOT ▪ WMATA operations center ▪ MCTMC ▪ Select operations centers for agencies not connected to RITIS	▪ Operations and maintenance personnel ▪ Traffic managers	▪ Assess incidents occurring throughout the region to determine if the incident will affect traffic operations in their area. ▪ Review traffic and roadway conditions in the region ▪ Provide data from agency transportation and incident management systems
Control center and dispatch center managers	▪ DDOT ▪ VDOT ▪ MDOT ▪ WMATA operations center ▪ Select operations centers for agencies not connected to RITIS	▪ Control center manager ▪ Dispatch center manager	▪ Monitor systems using RITIS data (such as freeway management, transit management) ▪ Use RITIS data as impetus to coordinate with other agency functions
Operators and dispatchers	▪ DDOT ▪ VDOT ▪ MDOT ▪ WMATA ▪ Montgomery County ▪ Select operations centers for agencies not connected to RITIS	Operators and dispatcher	▪ Monitor and operate agency systems and input and initiate RITIS communications ▪ Monitor, extract, and interpret data from RITIS for potential response ▪ Based on RITIS data, notify other staff, supervisors, internal and external departments, and appropriate authorities of adverse conditions requiring a response

User Class	Agencies/Organizations	Positions	Interactions with RITIS
Transit operations center	▪ WMATA (MetroBus and MetroRail) ▪ Maryland Transit Administration ▪ Virginia Railway Express ▪ Montgomery County Ride-on Bus Service ▪ Amtrak	▪ Operations center staff ▪ Route supervisors	▪ Provide data on transit operations and disruptions ▪ Monitor incidents, traffic, road conditions, and weather ▪ Assess need for rerouting buses; determine best alternative route ▪ Based on RITIS data, request signal change/preemption ▪ Plan bus detours ▪ Use RITIS data to inform drivers and passengers of incidents affecting transit operations
Service patrols	▪ VDOT ▪ MDOT ▪ DDOT ▪ Montgomery County	Patrollers and supervisors	▪ Monitor events in service area ▪ Evaluate events with potential impact on service area ▪ Manage traffic around incidents ▪ Provide information about incidents and roadway conditions to TMC operators ▪ Evaluate performance of service patrol activities
Signal operations agencies	▪ VDOT ▪ DDOT ▪ MDOT ▪ Montgomery County	Signal engineers	▪ Provide signal status data ▪ Monitor traffic conditions and signal systems status ▪ Use CCTV for problem validation ▪ Use alerts to notify operations staff of traffic problem ▪ Use RITIS data to determine need to adjust signal operations

User Class	Agencies/Organizations	Positions	Interactions with RITIS
Management personnel for operations and maintenance	▪ VDOT ▪ MDOT ▪ DDOT ▪ Montgomery County ▪ WMATA	Managers	▪ Use RITIS information for decisionmaking, coordinating resources, and directing staff for incident response ▪ Supervise operations staff who enter or access RITIS-accessible data ▪ Use RITIS to coordinate programs such as maintenance, construction, and special events with state and local jurisdictions
Roadway and transit construction and maintenance personnel	▪ VDOT ▪ MDOT ▪ DDOT ▪ Montgomery County ▪ WMATA	▪ Road crews ▪ Managers ▪ Dispatchers	▪ Monitor travel conditions in work area ▪ Provide TMC staff with information on on-scene conditions for work area
Public Safety			
Public safety operators and dispatchers	911 centers	Call takers and dispatcher	Log call and dispatch information into CAD, to be shared through RITIS

User Class	Agencies/Organizations	Positions	Interactions with RITIS
Emergency Responders			
Law enforcement agencies	▪ MD State Police ▪ VA State Police ▪ DC Metropolitan Police Department ▪ Metro Transit Police ▪ Montgomery County Department of Police ▪ Other law enforcement agencies using CapWin	▪ Police officers ▪ Barracks commanders ▪ Police dispatchers ▪ Managers	▪ Provide information and updates to operators and dispatchers who then update RITIS through CapWin and CAD interface ▪ Monitor incidents ▪ Review traffic conditions to determine best route for incident response ▪ Monitor events outside their service areas and evaluate the impacts of these events on activities in their area.
Fire departments and emergency medical services	Select municipal fire departments and emergency medical service providers	Firefighters and emergency medical service providers and managers	▪ Share CAD data through RITIS ▪ Monitor incident using CCTV ▪ Choose best route to incident using RITIS data and video
Hazardous material responders	▪ Hazardous materials agencies ▪ Contractors	Hazardous material clean-up personnel	▪ Use CCTV to view crash scene and determine equipment needed before dispatching ▪ Provide information on recommended actions (e.g., evacuations, rerouting traffic) regarding hazmat incidents to TMCs
Tow truck operators	Towing companies	Two truck drivers and dispatchers	▪ Use CCTV pictures to determine needed equipment ▪ Check desired route for delays prior to dispatching. ▪ Review incident information before dispatching

User Class	Agencies/Organizations	Positions	Interactions with RITIS
Incident clean-up crews	▪ Private sector clean-up companies ▪ State and local governments	▪ Road crews ▪ Clean-up crew managers	▪ Use CCTV/pictures to view crash/incident scene before dispatching ▪ Check desired route for delays prior to dispatching. ▪ Review incident information before dispatching
Travelers			
Private vehicle travelers			▪ Receive alerts via RITIS subscription service on cell phone/pager/PDA/e-mail ▪ Information provided to travelers via RITIS about road conditions, events, transit schedules and fares, navigational instructions, etc. will allow them to make informed decisions about their travel patterns.
Transit users			▪ Access RITIS for transit delays or emergency incidents in the region. ▪ Information shared over RITIS about delays, emergencies, or other incidents will be passed to transit riders when they seek out transit information by phone, web sites, from transit drivers, or other traveler information services.
Transit vehicle operators	▪ WMATA (MetroBus, MetroRail) ▪ Maryland Transit Administration ▪ Virginia Railway Express ▪ Montgomery County Ride-on Bus Service ▪ Amtrak	Bus and train drivers	▪ Receive incident information from transit operations center. ▪ Inform transit riders of incidents.

User Class	Agencies/Organizations	Positions	Interactions with RITIS
Freight vehicle operators	Shippers	Truck drivers	▪ Use RITIS incident, traffic and roadway condition data to plan route ▪ Monitor ATIS ▪ Map alternate routes
Information Service Providers			
Traveler information service providers	▪ VDOT ▪ DDOT ▪ MDOT ▪ Montgomery County ▪ 511 ▪ TrafficLand ▪ OnStar ▪ Event venues ▪ Satellite radio	▪ Traffic reporters ▪ Information technology staff	▪ Receive RITIS ATIS data ▪ Use RITIS traffic information data to provide ATIS to travelers ▪ Use information from RITIS to develop 511 messages
Media	▪ Television and Radio ▪ WTOP ▪ Satellite Radio	Traffic reporters	▪ Receive RITIS ATIS data ▪ Use RITIS traffic information data to provide ATIS to travelers
Public affairs offices	Transportation operations and planning agencies	Public affairs personnel	▪ Monitor RITIS for pertinent information and notifications from other agencies. ▪ Receive RITIS alerts
Archive Data Users			
Archived data users	▪ Universities ▪ MWCOG ▪ Transportation operations agencies ▪ Consultants ▪ I-95 Corridor Coalition	▪ Researchers ▪ Public sector transportation planners and engineers ▪ Consultants	▪ Assess traffic trends to help understand congestion, safety, growth, etc. ▪ Monitor system performance ▪ Prepare transportation plans and programs ▪ Input archived data into travel models ▪ Conduct after-action reviews
Program/System Administration			

User Class	Agencies/Organizations	Positions	Interactions with RITIS
Oversight committee	• MWCOG • MATOC Steering Committee	Managers and IT staff	Provide overall guidance, contract management, system enhancement, planning, and funding functions for RITIS
System managers	To be determined	To be determined	Establish and administer policies and procedures for RITIS.
Information Technology			
Developer	CATT Laboratory	Computer programmers and systems engineers	▪ Write and test software code ▪ Integrate RITIS with other systems ▪ Manage system development
System maintenance personnel	▪ CATT Laboratory ▪ CapWin ▪ Others to be determined	Computer programmers and systems engineers	▪ Manage system and data archive ▪ Diagnose and fix operational problems ▪ Maintain a record of system maintenance and upgrades ▪ Maintain test system ▪ Fix bugs in test system; implement changes in production system
User support personnel	To be determined	Computer programmers and systems engineers	▪ Update training materials ▪ Train users ▪ Answer user questions ▪ Refer unresolved problems to RITIS maintenance staff ▪ Maintain log of all user support responses and activities

User Class	Agencies/Organizations	Positions	Interactions with RITIS
System administrators	To be determined	To be determined	▪ Maintain data sources and links ▪ Backup data regularly ▪ Maintain a uniform, consistent interface to data for maintenance personnel ▪ Maintain system and database system security ▪ Maintain user accounts ▪ Maintain log of use statistics ▪ Maintain computer systems, database servers, and web servers ▪ Ensure integrity of system
Information Technology Staff	▪ VDOT ▪ MDOT ▪ DDOT ▪ Montgomery County ▪ WMATA ▪ Future agencies connected to RITIS	Agency IT system development and maintenance personnel	▪ Maintain communications network to ensure data and information flows from agency data system to RITIS ▪ Develop, repair, and maintain agency software, equipment, databases ▪ Maintain interfaces between RITIS and agency databases and systems, including system security
Other			
Commercial freight dispatchers	Freight carriers	Dispatchers	Monitor incidents in order to notify drivers of incidents and recommend alternate routes.

APPENDIX B. TYPES OF SHARED DATA

Incident information. A central RITIS requirement is to constantly capture incident data entered by operations center personnel in real time and share the information among jurisdictions. Any subsequent updates to incident records will also be distributed. Data captures will include the originating agency, incident date and time, location, description, and lane status. RITIS will allow the assignment of a level of severity to each incident as well as the ability to associate and track all messages related to a particular incident. Other RITIS users will have the ability to view the regional incident records and users from participating agencies will be able to update the information. It is anticipated that incident data from all sources will be incorporated into each agency's native system. Figure B-1 shows an example of an incident management display.

Figure B-1 Sample Incident Data List and Lane Status Detail

State: MD: I-95 PAST EXIT 100
Type: - accident
Time: 07/19/2006 – 2:32:06 PM
Lane Status: View.

State: MD: S/B I-95 EXIT RAMP TO I/L I-695 (X-64)
Type: - disabled vehicle
Time: 07/19/2006 – 3:17:41 PM
Lane Status: View.

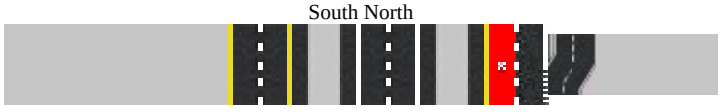
State: MD: US 1 @ EASTERN AVE
Type: - debris on roadway
Time: 07/19/2006 – 1:40:50 PM
Lane Status: View.

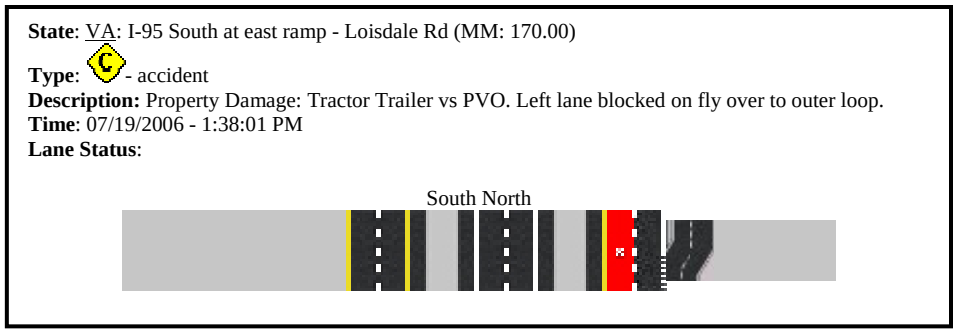
State: MD: ALT. US 40 PAST MIDDLETOWN AT EASTERN CIR. (DO NOT DEL. 7/20/06)
Type: - emergency maintenance
Time: 07/06/2006 – 5:29:00 PM
Lane Status: View.

State: MD: I-495 PRIOR MD 187
Type: - traffic congestion
Time: 07/19/2006 – 2:47:05 PM
Lane Status: View.

State: VA: I-95 South at east ramp - Loisdale Rd (MM: 170.00)
Type: - accident
Description: Property Damage: Tractor Trailer vs PVO. Left lane blocked on fly over to outer loop.
Time: 07/19/2006 - 1:38:01 PM
Lane Status:

South North





RITIS will provide TMCs throughout the region with the ability to identify, assess, and monitor incidents occurring outside their jurisdiction to determine if the incident will affect their traffic or transit operations. A crash adjacent to a jurisdictional boundary would trigger the need for scrutiny of traffic conditions. Transit operators will use RITIS incident data to inform transit drivers and riders of incidents affecting transit operations. Emergency responders (through CapWin) will utilize RITIS incident information to keep up to date on transportation activities in the area of an incident.

CAD data. Crashes or roadside incidents are often captured by 911technologies in use by public service agencies. This is frequently the first opportunity for incident detection. RITIS will collect 911 data directly from regional CAD systems or indirectly through TMCs that already receive this information. It will filter the data using incident codes for transportation-related events, and distribute the CAD messages to all participating agencies. RITIS should also capture and disseminate updates and additional information gained from subsequent calls. Data to be captured will include incident date, time, severity, type, location, and description.

There are multiple CAD systems in operation in the region. Virginia, for example, has nine independent E-911 networks. Each system might support 10 to 25 public safety answering points. RITIS will be able to convert internal CAD incident representation on different CAD systems into a common format for regional dissemination.

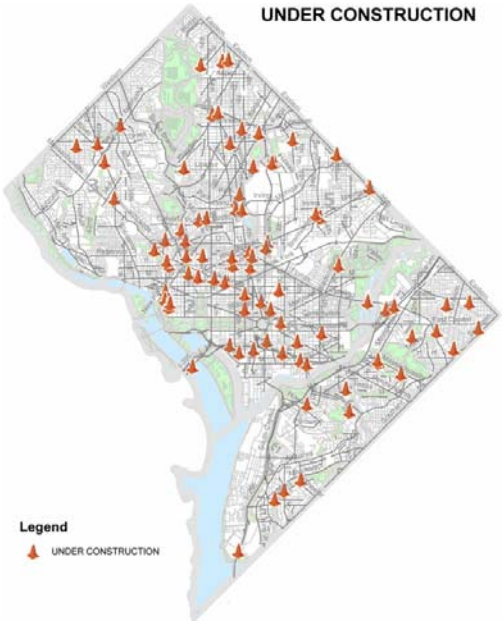
CAD data will supplement TMC data. It will enable participating agencies to more quickly detect incidents and improve response time, situational awareness, and incident management.

Planned closures and events. As an information-sharing and data-storage mechanism, RITIS serves as a valuable tool for agencies directly involved in event transportation issues and logistics and as an information tool for other agencies that may need to be aware of events, construction, or other activities to assess potential impacts to their own operations.

Planned closures and events restrict portions of the transportation network for a specified time and duration and often require unique traffic control and management strategies. RITIS will capture and distribute information on planned closures and events such as construction and maintenance work zones, road closures, lane

closures, travel restrictions, and special events. RITIS will consolidate region-wide planned event information into a map and a text-based calendar allowing users to access planned event information by date and location. A sample map display of one day's planned construction activities and a sample detailed description of a planned construction activity are shown in Figure B-2.

Figure B-2 Sample Construction Map and Detail



DDOT Street Construction Detail
Street Name: 3rd St
Quadrant: NE
Ward: 6
Secondary Ward:
From Intersection: East Capitol St
To Intersection: A St
Number of Blocks: 1
Actual Date: 9/16/2002
Work Type: REC
Work Description: Reconstruction
Functional Class: Local
Contract Group: FY99B-REC
Contract Number: 01-
Federal Aid Number:
DC Number:
Agreement:
Percent Complete: 60%
Project Name:

Data captured will include event name, location, date, time, duration, description, traffic management strategies, roadway impacts, and special security considerations. RITIS will constantly update and verify this information to ensure agencies are providing real-time information to each other and to motorists. RITIS will be able to associate multiple entries about a single event.

This information will provide situational awareness of event activities in the region to help agencies better plan for near-term, known impacts to the region's transportation system. Agencies will utilize planned event data to assess the potential impacts of the event to their operations. Shared maintenance and construction data will allow for coordinating road construction schedules to ensure better management of regional roadways. Emergency responders can use this information to route response units around the affected areas.

Detours. RITIS will be able to capture and disseminate detour information. Transit operators will use detour data to inform transit drivers and riders of incidents or events affecting transit operations. Signal personnel will be able to accommodate transit vehicles by adjusting signal timing/preemption on detour routes. Emergency response agencies can use detour information to route first responders and to plan routes for escorting dignitaries. Emergency managers will be able to see detours that could affect an evacuation route.

Metro service disruptions. Rail and bus service might be adjusted system wide in response to traffic disruptions. These adjustments, along with other information that affects system operation and accessibility, are reported in several Metro reports that will be captured in RITIS and distributed. Figure B-3 shows a typical service disruption list.

Figure B-3 Sample Service Disruption List

Washington Metropolitan Area Transit Authority

Rosslyn elevator and escalator status

Location	Status	Out of service as of	Expected return to service
Elevator between skywalk, street, and upper platform	operating		
Elevator between upper platform and lower platform	operating		
Escalator between mezzanine and upper platform	operating		
Escalator between mezzanine and upper platform	operating		
Escalator between mezzanine and upper platform	operating		
Escalator between mezzanine and upper platform	operating		
Escalator between upper platform and lower platform	operating		
Escalator between upper platform and lower platform	operating		
Escalator between upper platform and lower platform	operating		
Escalator between upper platform and lower platform	operating		
Escalator between skywalk and mezzanine	out of service	05/15/2006	09/15/2006
Escalator between skywalk and mezzanine	Turned off (Stairway only)*		

Traffic flow data. RITIS will collect and distribute regional traffic flow data and provide the ability to display this information graphically on the RITIS web site (see Figures B-4, B-5, and B-6). RITIS will also provide device and communications status information.

Figure B-4 Speed Detector Map Display

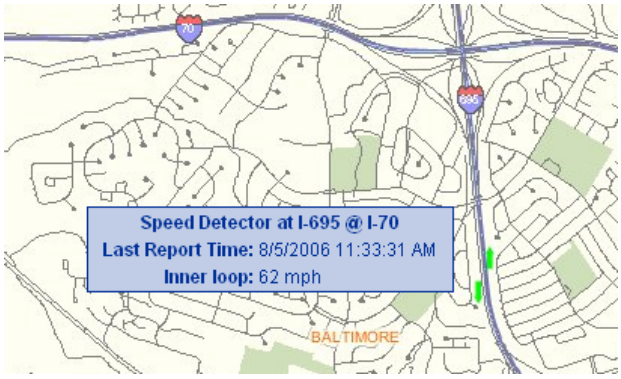


Figure B-5 Congestion Map Display

16th St., Harvard St., and Mount Pleasant St. NW

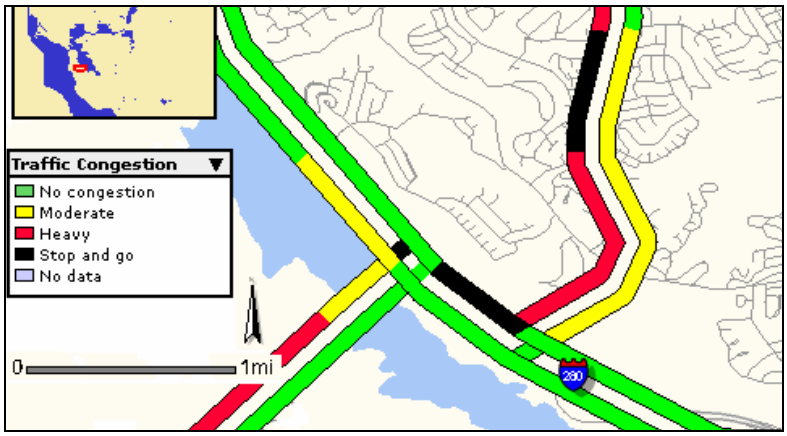


Figure B-6 Traffic Speed Data List

Traffic Speed Data

This data will automatically refresh every five minutes.

0-30 mph
30-50 mph
> 50 mph

Location	Average Speed	Last Reported
I-270 @ Comus Rd North	Over 65 MPH	8/5/2006 11:07:44 AM
I-270 @ MD 118 North	Over 65 MPH	8/5/2006 11:12:13 AM
I-270 @ MD 118 South	Over 65 MPH	8/5/2006 11:12:12 AM
I-270 @ MD 85 South	Over 65 MPH	8/5/2006 11:07:34 AM
I-270 @ Weigh Station South	Over 65 MPH	8/5/2006 11:08:31 AM
I-270 at Doctor Perry Rd North	Over 65 MPH	8/5/2006 11:07:37 AM
I-270 between Grosvenor Ln & MD 187 Southbound	Over 65 MPH	8/5/2006 11:07:44 AM
I-270 btn Park Mills Rd & Scenic Overlook North	Over 65 MPH	8/5/2006 11:12:12 AM
I-270 North at MD 121 North	Over 65 MPH	8/5/2006 11:08:29 AM
I-270 S/B @ I-370 S/B Local Lanes	58.9 MPH	8/5/2006 11:08:18 AM
I-270 S/B @ I-370 N/B Local Lanes	62 MPH	8/5/2006 11:12:09 AM
I-270 S/B @ I-370 S/B Express Lanes	Over 65 MPH	8/5/2006 11:08:18 AM
I-270 S/B @ I-370 N/B Express Lanes	56.6 MPH	8/5/2006 11:12:09 AM
I-270 South at MD 121 South	Over 65 MPH	8/5/2006 11:11:54 AM
I-270 South between MD 80 & Park Mills Rd North	Over 65 MPH	8/5/2006 11:11:45 AM
I-495 @ Greentree Road Inner Loop	Over 65 MPH	8/5/2006 11:12:08 AM
I-495 @ Greentree Road Outer Loop	Over 65 MPH	8/5/2006 11:12:08 AM
I-495 @ I-95 Outer loop	Over 65 MPH	8/5/2006 11:08:18 AM
I-495 @ I-95 Inner loop	Over 65 MPH	8/5/2006 11:08:21 AM
I-495 @ MD 190 Inner loop	56.2 MPH	8/5/2006 11:08:22 AM
I-495 @ MD 190 Outer loop	Over 65 MPH	8/5/2006 11:11:23 AM
I-495 @ Seminary Rd Outer loop	Over 65 MPH	8/5/2006 11:11:23 AM
I-495 btn MD 97 & US 29	Over 65 MPH	8/5/2006 11:08:44 AM
I-695 @ Harford Rd Innerloop	Over 65 MPH	8/5/2006 11:08:40 AM
I-695 @ I-70 Inner loop	Over 65 MPH	8/5/2006 11:08:31 AM
I-695 @ US 1 Belair RD East Bound	Over 65 MPH	8/5/2006 11:08:44 AM
I-83 @ Cold Bottom Rd South	34.4 MPH	8/5/2006 11:07:35 AM
US 50 @ Bay Dale East	10.3 MPH	8/5/2006 11:08:05 AM
US-50 @ MD-70 (Rowe Blvd) East	14.8 MPH	8/5/2006 11:08:40 AM

In addition to real-time traffic data, RITIS will include historical speed and volume data that can be compared with real-time data to check data quality. It will also provide prevailing free flow speeds by road segment, hour of day, and day of week.

TMC operators will use real-time traffic sensor information to assess current traffic conditions and adjust traffic control strategies. Transit operators will use RITIS it to inform transit drivers and riders of incidents affecting transit operations.

Traffic signals. For incidents near jurisdictional boundaries, setting up diversions for crashes cannot be done by single jurisdictions alone; close coordination with neighboring jurisdictions is essential. RITIS will provide traffic operations agencies

with real-time visibility of signal status in other jurisdictions. Initial RITIS implementation will not allow for control of these devices. Archived signal timing data can be used in simulations for evacuation planning and for analysis of clearance times for crash events.

Variable message signs. RITIS will provide information on VMS in the region (see Figure B-7). RITIS will capture each VMS' unique identifier, location, device type, owner, and real-time information such as message displayed and message date and time. Regional visibility of VMS postings will promote conformity for VMS usage and foster message standardization. RITIS will provide the situational awareness necessary to ensure that VMS messages are accurate.

Figure B-7 Sample CHART VMS Display List

Location	Message
I-95 South prior to Ex. 33 MD 198 Sign# 320	STADIUM EVENT FOR INFO TUNE RADIO 1630 AM
I-97 South prior Ex 10, Benfield Blvd Sign# 512	ACCIDENT US 50 EAST AT EXIT 31 2 RIGHT LANES CLOSED
I-97 North prior to Ex. 17 I-695/I-895 Sign# 508	ROADWORK ON RAMP TO I-895 NORTH RIGHT LANE CLOSED
I-495 I/L (East) prior to Ex. 28 Md 650 Sign# 322	STADIUM EVENT I-95 SOUTH TO EXITS 17 OR 15
I-95 South, South of Ex. 29 Md 212 Sign# 319	STADIUM EVENT I-95 SOUTH USE EXITS 17 OR 15
E/B U.S. 50 @ Md. 665 Sign# 912_P	ACCIDENT US 50 E EXIT 31 2 RIGHT LANES CLOSED
I-95/495 I/L, (South) prior EX 20 MD 450 Sign# 317	STADIUM EVENT PARKING USE EXITS 17 OR 15 STAY ALERT
US 50 West, prior EX 7 I-95/ 495 Sign# 314	STADIUM TRAFFIC USE I-95 SOUTH TO EXITS 17 OR 15

HAR. RITIS will have the ability to capture and distribute HAR system information, including activation status and messages being broadcast. Notification of HAR

activation will allow operators of other regional HAR systems to make necessary changes to their information, accounting for HAR messages in other jurisdictions.

In addition to the message itself, RITIS will capture HAR equipment physical location, coverage areas, operating agency, and status. Archived data on HAR activation, along with traffic flow data, will allow analysis of the effectiveness of these systems and estimates of traveler compliance that can be used in planning for events like evacuations.

HOV lanes. RITIS will capture regional HOV usage, lane status, operating direction, restrictions, location, operating agency, and hours of operation.

Lane control devices. Lane control signals are used to control HOV lanes, reversible lanes, and lane closures. RITIS will capture and disseminate lane control signal status. It will also provide the situational awareness necessary to coordinate lane signage among neighboring jurisdictions.

Video. RITIS will collect and redistribute CCTV video from participating agencies and private providers and make it available to all other participating agencies and travel information service providers. It will support distribution of both streaming video and frequently updated still images. This will allow TMC operations staffs to track traffic conditions at key locations throughout the region. RITIS will capture and distribute camera identification number, location, owner, coverage area, type, operational status, and video. Figure B-8 shows a typical CCTV display.

Figure B-8 Sample CCTV Display

Real-time on-demand video monitoring will improve incident detection and verifications. Transit operations staff can use CCTV to monitor bus stop locations and movements within video range. CCTV information will allow VMS operators and other traveler information providers to present messages that accurately reflect traffic conditions. Video images can be shared with the police and fire departments and hazardous materials responders.

Weather and road condition data. To facilitate weather-responsive traffic management, RITIS will include NWS radar feeds and weather alerts. This information will be available as a layer on RITIS's mapping function. RITIS will not store weather radar data because radar is too data-intensive.

Using detailed, specific weather information, TMCs can initiate travel-related mitigation strategies such as issuing advisories to travelers (e.g., low visibility alerts), provide treatments such as deicing or salting roadways and bridges, and implement control measures such as adjusting traffic signal timing.

Vehicle location. RITIS will capture and disseminate the location of buses, roadway service patrol vehicles, roadway patrol vehicles, and emergency responders (where available). These locations can be mapped in real time. Sensitive information would not be disseminated beyond authorized users. Data collected include vehicle identification numbers, description, owner, and location.

APPENDIX C. ABBREVIATIONS

ADUS	Archived data user services
AVL	Automatic vehicle location
C2C	Center-to-center
CAD	Computer-aided dispatch
CATT	Center for Advanced Transportation Technology
CCTV	Closed circuit television
ConOps	Concept of operations
DDOT	District of Columbia Department of Transportation
DOT	Department of Transportation
E-911	Enhanced 911
EMS	Emergency management services
GIS	Geographic information system
HAR	Highway advisory radio
HOV	High-occupancy vehicle
IT	Information technology
ITS	Intelligent transportation system
MATOC	Metropolitan Area Transportation Operations Coordination
MCTMC	Montgomery County Traffic Management Center
MDOT	Maryland Department of Transportation
MWCOG	Metropolitan Washington Council of Governments
NPS	National Park Service
NTCIP	National Transportation Communications for ITS Protocols
NWS	Nation Weather Service
O&M	Operations and maintenance
RITIS	Regional Integrated Transportation Information System
RSS	Really simple syndication
RWIS	Road weather information system
TMC	Transportation Management Center or Traffic Management Center
VDOT	Virginia Department of Transportation
VMS	Variable message sign
WMATA	Washington Metropolitan Area Transit Authority

APPENDIX D. COPOPS STAKEHOLDER MEETING ATTENDEES