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FEDERAL TRANSIT ADMINISTRATION

Evaluation of Regional Real-time Transit Communications and Data Information Sharing in the National Capital Region

MARCH 2015

FTA Report No. 0079
Federal Transit Administration

PREPARED BY
Reuben M. Juster
Thomas H. Jacobs
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University of Maryland Center for Advanced Transportation Technology (CATT)

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Federal Transit Administration
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Metric Conversion Table

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liter	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

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13. ABSTRACT

This final report documents transit-related enhancements to the Regional Integration Transportation Information System (RITIS), creation of the RITIS Chat Instant Messaging tool, and final project evaluation of the effectiveness of the RITIS Chat tool through a simulated incident with participants from transit agencies that actively use RITIS and members of the MATOC Operations staff.

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ABSTRACT

The National Capital Region (NCR), centered around Washington DC, has a multitude of different highway, transit, and safety agencies that are dedicated to serve their own jurisdictions. The Metropolitan Area Transportation Operations Coordination (MATOC) program was created and continues to operate to facilitate information-sharing and collaboration among NCR agencies. The web-based Regional Integration Transportation Information System (RITIS) suite, which was developed by the University of Maryland's (UMD) Center for Advanced Transportation Technology Laboratory (CATT Lab), enables MATOC to function as an information-sharing organization and allows participating NCR agencies to gather and submit information to MATOC.

This project included three components: transit-related enhancements in RITIS, creation of the RITIS Chat instant messaging tool, and final project evaluation.

Transit agencies have been able to use RITIS for incident, weather, and traffic information, but prior to this project, RITIS did not have the capability to ingest transit data such as transit infrastructure/vehicle location and transit vehicle arrival times. Transit enhancements have enabled RITIS to ingest and intuitively display transit data.

Before the creation of the RITIS Chat tool, communication among RITIS users was restricted to in-person conversations, phone calls, or emails. These communication methods can be a burden to operators when they must multi-task during emergencies. Through this project, the CATT Lab was able to create the RITIS Chat tool, which allows opted-in RITIS users to communicate via instant messaging. The RITIS Chat tool can be used to contact individuals on a one-on-one basis or as a chatroom linked with an incident.

The effectiveness of the RITIS Chat tool was evaluated through a simulated incident with participants from transit agencies that actively use RITIS and members from the MATOC Operations staff. Throughout the scenario, participants used or said how they would use RITIS. The simulation activity ultimately showed that both the RITIS Chat feature and transit enhancements were good investments but require greater participation from the transit agencies within the NCR to reach their full potential.

EXECUTIVE SUMMARY

This report examines the effectiveness of the Regional Integration Transportation Information System (RITIS) upgrades made through the "Evaluation of Regional Real-time Transit Communications and Data Information Sharing for Enhanced Multi-modal Incident Information Sharing and Collaboration in the National Capital Region" project.

The Metropolitan Area Transportation Operations Coordination (MATOC) program received congressionally-designated funds to facilitate better coordination among the transportation and transit systems of the National Capital Region (NCR). MATOC, along with the University of Maryland (UMD) Center for Advanced Transportation Technology (CATT), proposed using these funds to add additional transit functionality to RITIS by creating a RITIS Chat tool and documenting its value in enhancing regional transit communications. This proposed work scope was approved, and this report documents the effectiveness of the RITIS upgrades.

This report analyzes how the RITIS enhancements can:

- Improve interagency communication
- Decrease incident notification times
- Improve operator satisfaction (better direct communications capability and situational awareness)

The evaluation revealed that the RITIS Chat tool can facilitate inter-agency communication and collaboration during incidents. This tool allows transit agencies to seamlessly communicate to MATOC operators who directly receive information from other transportation and public safety agencies. All transit agency employees who volunteered in the evaluation exercise believed that the RITIS Chat tool improved their ability to communicate among one another and with MATOC and also increased their situational awareness.

NCR transit agencies and transit agencies around the world stand to benefit from this research. NCR transit agencies benefited with the transit-related enhancements to RITIS and the creation of the RITIS Chat tool. These features are being used throughout the NCR today. The research revealed some minor bugs in the RITIS Chat tool and identified a list of additional enhancements that the CATT Lab may pursue in the future. This study benefits other transit agencies by showing the value of investing in a common information sharing and collaboration service/platform such as MATOC and RITIS.

SECTION 1

Introduction

In 2009, Fiscal Year 2010 congressionally-designated funds were provided for the Metropolitan Area Transportation Operations Coordination (MATOC) program through the leadership of Maryland Congressman C. A. "Dutch" Ruppersberger to facilitate better coordination among transportation agencies in the National Capital Region (NCR). MATOC operations began in the fall of 2008 with a team of operations staff devoted to facilitating NCR regional incident notifications and information-sharing among the agencies partnered with MATOC. These agencies include the Virginia Department of Transportation (VDOT), the District Department of Transportation (DDOT), the Maryland Department of Transportation (MDOT), the Washington Metropolitan Area Transit Authority (WMATA), and the Transportation Planning Board (TPB) at the Metropolitan Washington Council of Governments (MWCOG).

With MATOC in place, the University of Maryland's Center for Advanced Transportation Technology Laboratory (CATT Lab) built the Regional Integration Transportation Information System (RITIS), a web-based tool that helps facilitate cooperation among the transportation agencies of the NCR and other regions. A proposal entitled "Evaluation of Regional Real-time Transit Communications and Data Information Sharing for Enhanced Multi-modal Incident Information Sharing and Collaboration in the National Capital Region" was developed to outline how the congressionally-designated funds were to be used. The proposal was approved in the summer of 2011 and included three deliverables: an Instant Message (IM) functional capability in RITIS, transit system data integration within RITIS, and a project evaluation report.

The implemented transit communication and data enhancements to RITIS will significantly improve the overall situational awareness of the NCR's multimodal transportation system, allowing for enhanced coordination and regional collaboration among all of the transportation and public safety agencies involved. As a result of this collaboration, the public ultimately will experience an increase in mobility during both normal operating conditions and during special situations such as pre-planned events, emergencies, or evacuations. This will improve the NCR's ability to respond to irregular conditions by coordinating transit and local departments of transportation (DOT) response plans and resources in real-time and by providing information to the public and the media. During normal operating conditions, these enhancements will facilitate increased coordination of transit services through better transit data availability. Benefits expected include time savings in terms of reduced person hours of delay and improved transit/traffic system performance with associated reduction in environmental impacts.

The remainder of this report is organized into four sections. The Background section contains further details about MATOC, RITIS, and the state of practice regarding transit data sharing and communication. The Project Components section elaborates on the three deliverables for the project. The Evaluation Activity section covers the evaluation activity used to assess the effectiveness of the RITIS Chat tool. The report closes with conclusions about this project. Following the body of the report is an appendix showing the slides used during the evaluation activity and the RITIS Chat log from the evaluation activity.

SECTION 2

Background

MATOC

Following experiences from the 9/11 attacks and other major incidents, transportation officials from Maryland, Virginia, the District of Columbia, and WMATA committed to share and coordinate their transportation systems' conditions and information management during regional incidents. On behalf of the region, TPB partnered with the major transportation agencies in creating MATOC. By integrating systems technologies, improving procedures and planning, and providing more accurate and timely transportation information to the public, regional transportation agencies are working together to make travel smoother and safer.

MATOC's mission is to provide situational awareness of transportation operations in the NCR. This is achieved through the communication of consistent and reliable information that enables operating agencies and the traveling public to make effective and timely decisions. MATOC, along with CATT Lab, will continue to develop the tools and processes needed to facilitate coordinated operating agency responses.

An initial MATOC benefit-cost assessment found that there is an average of 224 police-reported vehicle-related crashes per day across the NCR, with approximately 90 regionally-significant incidents per month. Events that MATOC monitors include traffic incidents, major construction activities on busy highways or arterials, significant disruptions to transit services, severe weather events, and large planned special events. The estimated annual benefit of direct MATOC action calculates to $12.9 million in mobility savings, which includes a greenhouse gas savings of more than $500,000. These do not include additional savings due to reductions in secondary incidents. With an annual operating cost of $1.2 million, which includes maintenance and enhancement support for RITIS, MATOC provides a benefit-to-cost ratio of about 10:1.

Origin

The process for creating MATOC was initiated in 2005 after Virginia Congressman Jim Moran obtained Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) funding for the program's initial development and implementation. Several priority planning and deployment activities were carried out between 2005 and 2007, including the development of a Concept of Operations and Program Management Plan prepared by the Volpe Center under the U.S. DOT. Most significantly, work was

initiated on the development of RITIS, a system that would allow, among other capabilities, the exchange of real-time transportation system operations data.

In the summer of 2007, a major milestone was achieved when a multi-state/agency agreement formalizing the establishment of MATOC was executed. MATOC was created as a regional independent entity of its "owner" organizations as represented on a Steering Committee made up of the regional DOTs and WMATA. The TPB at the MWCOG is a formal partner under the MATOC agreement and an ex-officio member of the MATOC Steering Committee. MWCOG staff continue to provide administrative support to MATOC.

MATOC operations where launched in the fall of 2008 with dedicated operations staff focused on the provision of regional incident notifications and coordinated information-sharing among the partner agencies.

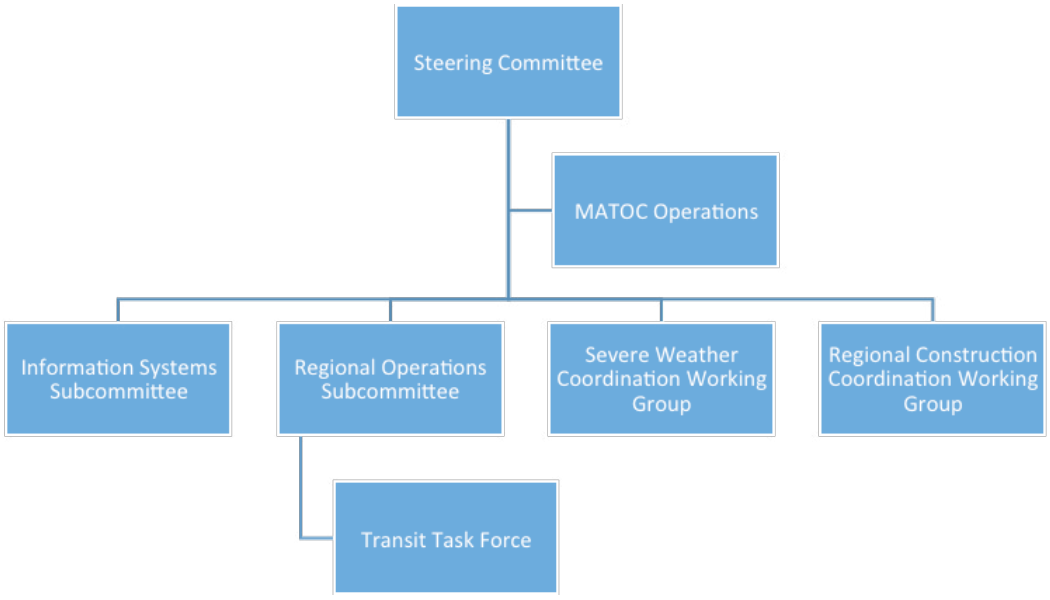
Operations

MATOC and its staff act as a "communications hub," ensuring that accurate and timely information on transportation incidents of a regional significance is shared among operations agencies and with the public. In addition to these responsibilities, the MATOC Facilitator leads, coordinates, and participates in the development of operating procedures, communications protocols, new system functionality, regional incident management plans, post-incident reviews, program outreach, and training.

Organizational Structure

Figure 2-1 illustrates the organizational structure of MATOC.

Figure 2-1
MATOC organizational structure



The MATOC Steering Committee is the governing body of MATOC and includes senior transportation operations officials from DDOT, MDOT/SHA, VDOT, and WMATA, with the MWCOG TPB transportation director as an ex-officio member. They ensure that the MATOC procedures are maintained and in concert with MATOC's stated mission and objectives. The MATOC Steering Committee also facilitates coordination among participating agencies to ensure that individual agency standard operating procedures and MATOC procedures coincide and are consistent. The following is a brief description of each MATOC organizational component.

MATOC Operations and its staff coordinate with transportation operators within the MATOC jurisdictions to ensure that coverage is available 16 hours per day, 5 days per week for regional incidents. During times of emergency and/or planned regional events, the MATOC staff provide extended coverage as needed. MATOC staff follow standard operating procedures for the region, as developed by the MATOC Operations Subcommittee.

The **Information Systems Subcommittee (ISS)** is responsible for developing regional information-sharing tools that enable timely and reliable sharing of information among agency transportation management systems. ISS develops and establishes automated communication links to the public such as the 511 system. It also recommends and implements solutions to technical issues associated with the gathering, sharing, and disseminating of information.

The **Operations Subcommittee (OPS)** develops standard operating procedures that define agency and MATOC responsibilities for sharing information with each other and the public and coordinating response actions in the aftermath of events, incidents, and emergencies that affect the performance of the transportation system in the NCR. OPS helps define the functionality of regional information systems to meet the information-sharing and response-coordination needs of MATOC and agency operations staffs. It identifies staffing requirements and needs and develops regionally-coordinated transportation management plans that can be quickly implemented when an incident or emergency occurs on a critical transportation link in the region. It also conducts post-incident reviews aimed at identifying ways of improving information-sharing tools, standard operating procedures, and operations staff performance.

The **Transit Task Force (TTF)** serves as a forum for discussing transit service coordination issues and improving communication, both real-time and in advance of known specific events. TTF advises the MATOC Steering Committee on transit operations topic areas and needed/desired improvements and was instrumental in helping oversee and guide the new functionality added under this project.

The **Severe Weather Coordination Working Group (CWCWG)** serves as a forum for NCR DOT maintenance representatives to best coordinate and communicate among the agencies regarding preparation, mobilization, and response prior to, during, and after a severe weather event. Members meet monthly during the winter season to discuss agency best practices and ongoing maintenance and road clearing issues.

The **Regional Construction and Work Zone Coordination Working Group (RCWZCWG)** includes NCR DOT representatives who work to reduce potential for conflicting lane/road closures and special events. The group schedules regular meetings for key personnel to discuss construction-related lane closures and special events and to share agency best practices. The group also develops enhanced public information resources as well as internal and external work zone information dissemination capabilities.

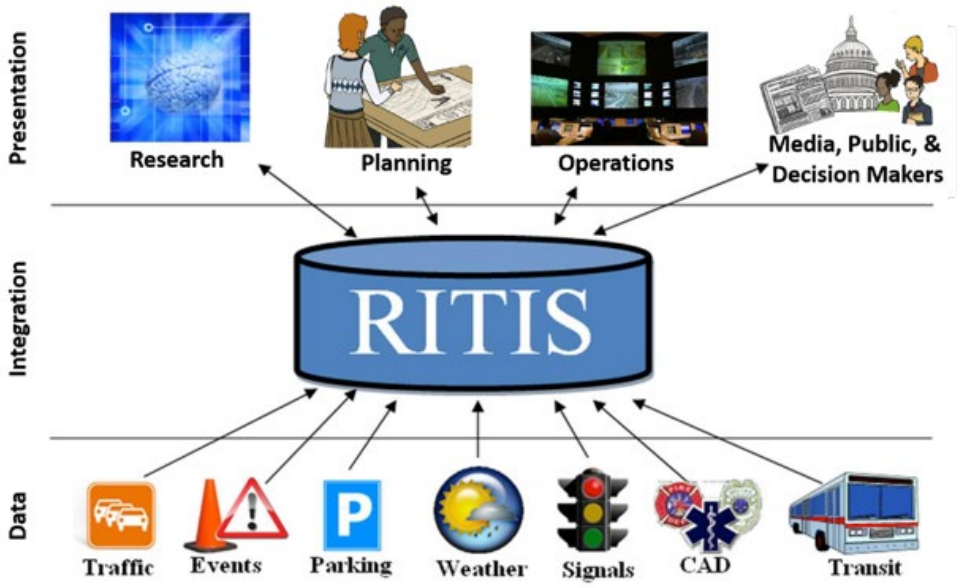
RITIS

The Regional Integrated Transportation Information System (RITIS) is an automated data sharing, dissemination, and archiving system that includes many performance measure, dashboard, and visual analytics tools that help transportation and public-safety agencies gain situational awareness, measure performance, and communicate information among agencies and the public.

RITIS automatically fuses, translates, and standardizes data obtained from multiple agencies to provide an enhanced overall view of the transportation network. Participating agencies are able to view transportation and related incident management information through innovative visualizations and use it to improve their operations and emergency preparedness. RITIS also uses regional standardized data to provide information to third parties, the media, and other traveler information resources, including web sites, paging systems, and 511. Figure 2-2 is a diagram of the RITIS system architecture.

There are more than 4,500 RITIS users as of the first quarter of 2015. RITIS ingests about 20,000 traffic crash records, 35 million traffic detector records, 4.2 billion probe vehicle data records, and immense amounts of Close Circuit TV (CCTV), weather, and radio records every day.

Figure 2-2
RITIS system architecture diagram



There are three main RITIS components:

- Real-time data feeds
- Real-time situational awareness tools
- Archived data analysis tools

Real-Time Data Feeds

RITIS data feeds are services that provide direct access to real-time incident, event, detector, probe, weather, transit, and other data sources, including Intelligent Transportation System (ITS) device status. RITIS data feeds are designed to facilitate integration of RITIS data back into legacy and third-party systems and for third-party application developers that need access to real-time information for dynamic mobility applications. The data feeds allow for flexibility both in data format and retrieval method. The RITIS platform allows each agency to determine which data elements it wishes to provide in the data feed or maintain secure and secluded from other agencies or the public.

Real-Time Situational Awareness Tools

The RITIS suite allows users with appropriate credentials to view all of the real-time RITIS data in a web browser. This is the component associated with the RITIS Chat tool. The website provides users with a dynamic set of visualizations and tools that afford efficient situational awareness. Authorized users can interact with live events, incidents, weather, sensors, radio scanners, and other data sources and devices in maps, lists, and other graphics. They can apply a rich

set of filters, access contact information, and even set up alerts. Figure 2-3 is a screenshot of the RITIS traffic map and incident list.

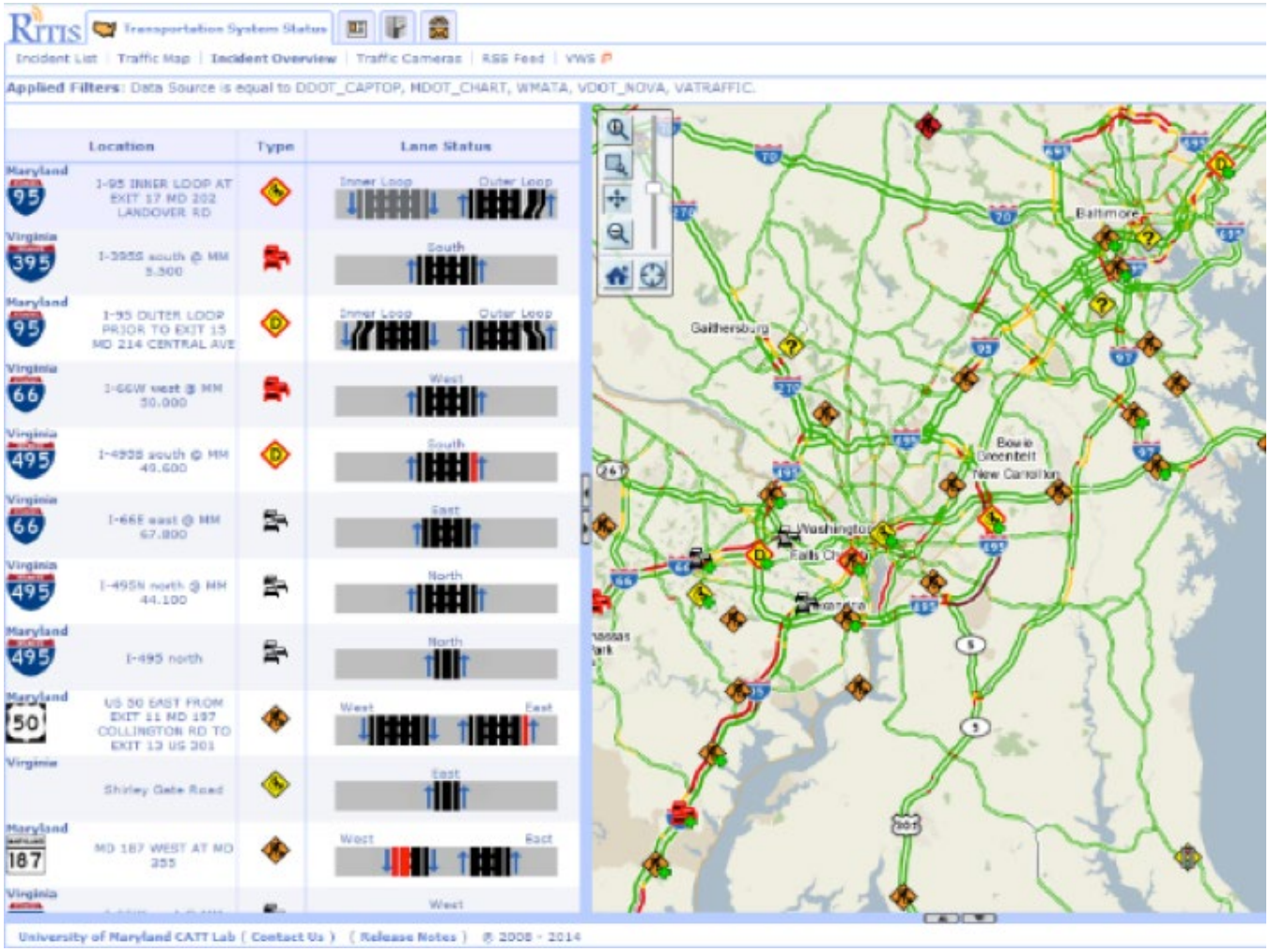


Figure 2-3 *RITIS traffic map and incident list*

Public safety or DOT employees who wish to get an account to the RITIS platform can do so by visiting https://www.ritis.org/register/ and filling out their contact information. There are no costs to gain access. Accounts are not given to the public or the private sector not under contract with DOTs due to the sensitive nature of some of the data.

Operations personnel from many different agencies use the real-time situational awareness tools as part of their day-to-day responsibilities. Real-life examples of how the real-time situational awareness tools were used are included in a later section.

Archived Data Analysis Tools

All data within RITIS are archived indefinitely, meaning that no data is ever deemed "too old" to be removed from user access. A number of online tools have been developed to allow users to query, analyze, and derive performance measures from the RITIS archive. Many of these tools are highly interactive and dynamic and have been developed with the user in mind to afford a high degree of freedom to explore the data with minimal training. Data within the archive also can be downloaded and/or exported so that users can perform their own independent analysis. These tools can allow users to identify incident hot-spots, analyze queue lengths and traffic congestion/bottlenecks at specific areas, perform after-action reviews, and evaluate the effectiveness of transportation operations strategies. Figure 2-4 is a screen shot of the RITIS detector data exporter.

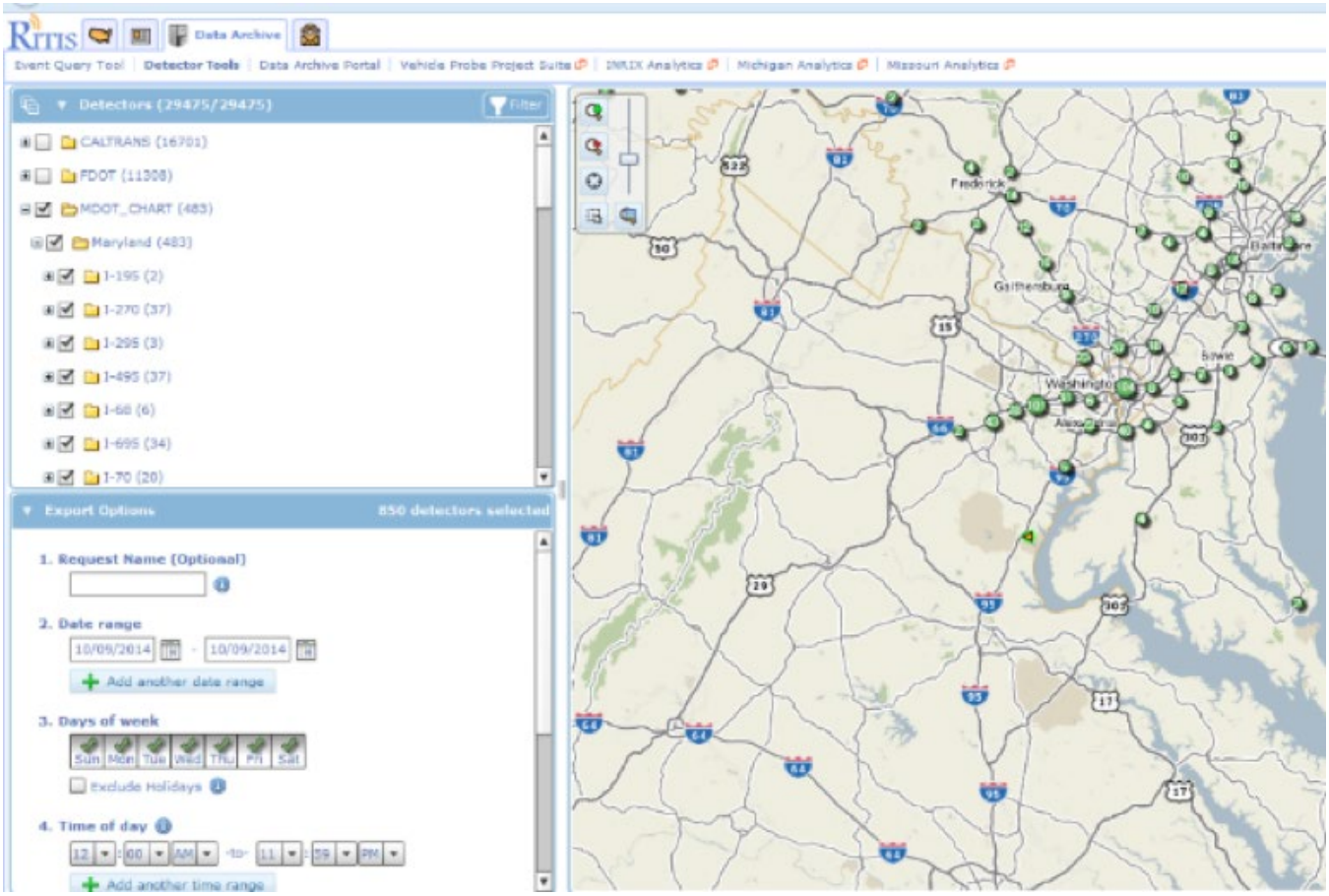


Figure 2-4 *RITIS Detector Data Exporter*

State of Practice

The collection and dissemination of regional transit system data for traveler information has been underway across the U.S. for years and is well-documented. This research project differs from others in that it deployed and evaluated a multi-agency transit communication and information-sharing capability for improved agency response to regional incidents. The primary purpose is transit-oriented incident management communication and coordination, which has not been a significant emphasis in previous research.

Transit management systems and, in particular, automatic vehicle location (AVL) systems were a significant source of data for this project. The use and resulting benefits of transit management systems by agencies in a particular jurisdiction have been documented. Transit Cooperative Research Program (TCRP) Synthesis 73, "AVL Systems for Bus Transit: Update" [1], documents the state of the practice of AVL systems in fixed-route and demand-responsive services as well as changes in agency practices related to the use of AVL systems and their benefits and costs.

From a regional transit system information integration perspective, the Metropolitan Transportation Commission (MTC) in the San Francisco Bay Area has implemented the Regional Transit Information System (RTIS) project [2]. This project delivers schedule, route, fare, and trip planning information on-line for 30+ Bay Area public transit agencies. The RTIS was created by MTC in cooperation with the Bay Area's transit agencies to collect, organize, and disseminate schedule, route, and fare information for the public transit providers in the Bay Area through 511/511.org. Like MTC, the practice of sharing consolidated transit data with the public is common in other metropolitan regions in the U.S., particularly those that have robust traveler information and/or 511 systems. In contrast to RTIS, the RITIS transit layer delivers real-time transit data such as vehicle location.

In National Cooperative Highway Research Program (NCHRP) Report 520, "Sharing Information Between Public Safety And Transportation Agencies for Traffic Incident Management" [3], a case study approach was used to compile projects that exemplified cutting-edge efforts to integrate transportation and public safety information systems, institutions, and operations. Types of traffic information and methods of sharing were researched, including detection and notification information, response information, incident scene management information, etc. Information-sharing methods included various voice and data technologies. However, in examining the transportation function, only traditional roadway operations (DOTs) were considered; transit agencies were not included.

The Federal Highway Administration (FHWA) sponsored research that examined the state of the art in evacuation transportation management [4]. The emphasis

was on evacuations in response to incidents where there is advance warning or when conditions are changing rapidly. The report documents emergency evacuation plans and practices employed by transportation organizations in several large metropolitan areas of the U.S. Survey results for metropolitan areas indicated "moderate" implementation regarding "coordination between TMCs, transit agencies, and EOCs [emergency operations centers]." Further, the report indicates relatively little coordination with transit in exercises and training for emergency evacuations; it is not clear from the report how coordination between TMCs, transit agencies, and EOCs takes place.

In the recent years, the private sector has been heavily involved into creating applications that aggregate and analyze transit data for both consumers and transit agencies. Companies such as Bishop Peak Technologies [5] and Transit Labs [6] have tools with the ability to collect and analyze transit data for transit companies using a web-based interface. These tools help agencies manage their operations and meet federal reporting requirements. On the passenger side, there is a multitude of consumer applications that take advantage of transit agency open data to create mobile applications that notify riders when a transit vehicle will arrive. For example, RideScout [7] is a consumer mobile application that aggregates real-time data for many modes of passenger transportation including transit, bike-share, car-share, and taxi. Consumers can enter a destination in RideScout, which will list the modes available with their estimated prices and travel times.

These applications help ingest transit data for transit agencies and passengers but can be used only if the transit agencies have the data. What differentiates RITIS from these applications and tools is its inclusion of non-transit data that is pertinent to transit operations such as real-time traffic speeds, traffic incidents, and weather information all in one place. With the inclusion of more transit data through this project, transit operators will have better situational awareness during incidents, and non-transit incident responders will be more informed about the location and condition of transit services.

This project helped to fill the gap of providing a capability and evaluation of real-time coordination and information-sharing between NCR transit agencies and DOTs through the RITIS platform.

SECTION 3

Project Components

The primary objectives of this research project were to (1) develop an instant-messaging (IM) capability within the RITIS platform that will allow real-time instant communications between regional transit agencies and MATOC partners, (2) integrate additional real-time regional transit system (bus and rail) data into RITIS, and (3) evaluate the use and benefits of real-time communication and sharing transit system status information amongst MATOC partners and other NCR agencies.

The project included the development and evaluation of an IM user interface along with a graphical user interface that allows MATOC operators and other real-time operations personnel to view live transit data, check system status, coordinate, and resolve issues from within RITIS.

RITIS Chat

The IM function, known as RITIS Chat, was developed to facilitate communication among all agencies participating in MATOC, not just transit. The IM tool was added into the RITIS suite in February 2013 and is used on a daily basis. Each recorded ground transportation related incident in the NCR has a chatroom associated with it, a sample screenshot of which is shown in Figure 3-1.

When an incident is created within RITIS, a chatroom is created automatically and users may enter the chatroom at their own discretion. Users within the chatroom can invite other users into the chatroom. Users may set their status to let others know if they are available or away. The chat feature also can be used without an incident for one-on-one communication. All conversations within RITIS Chat are recorded for accountability and retrospection.

RITIS Chat has become a vital part in many agencies' operations. In the following example, the Potomac and Rappahannock Transportation Commission (PRTC), a transit agency serving Virginia municipalities located 25 miles southwest of Washington DC, used RITIS Chat and other RITIS tools to manage services during a minor incident. PRTC personnel detected an incident that was along one of their bus routes on a routine check of the RITIS traffic map. The PRTC operator clicked on the incident and brought up the incident's event timeline, which is shown in Figure 3-2.

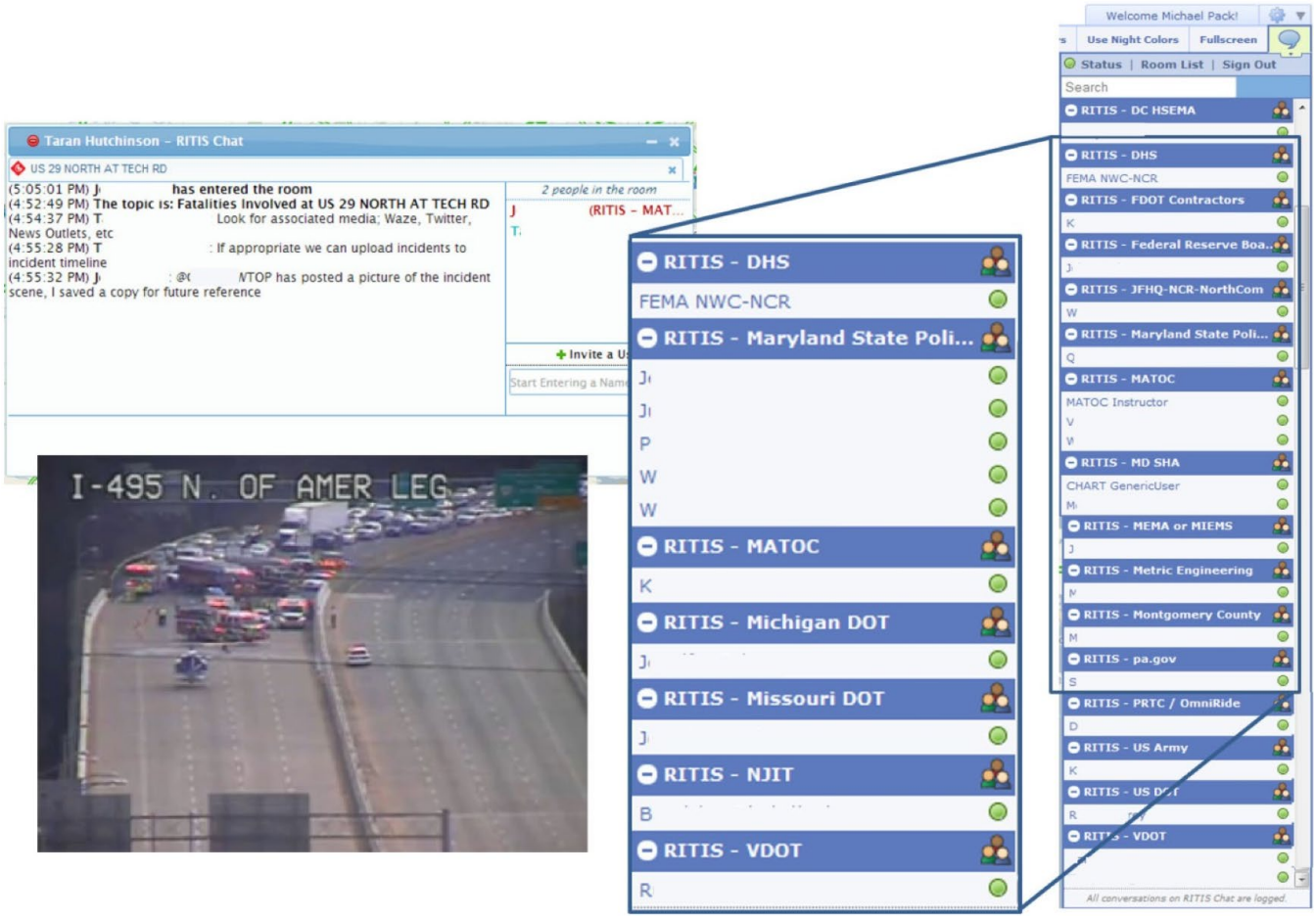
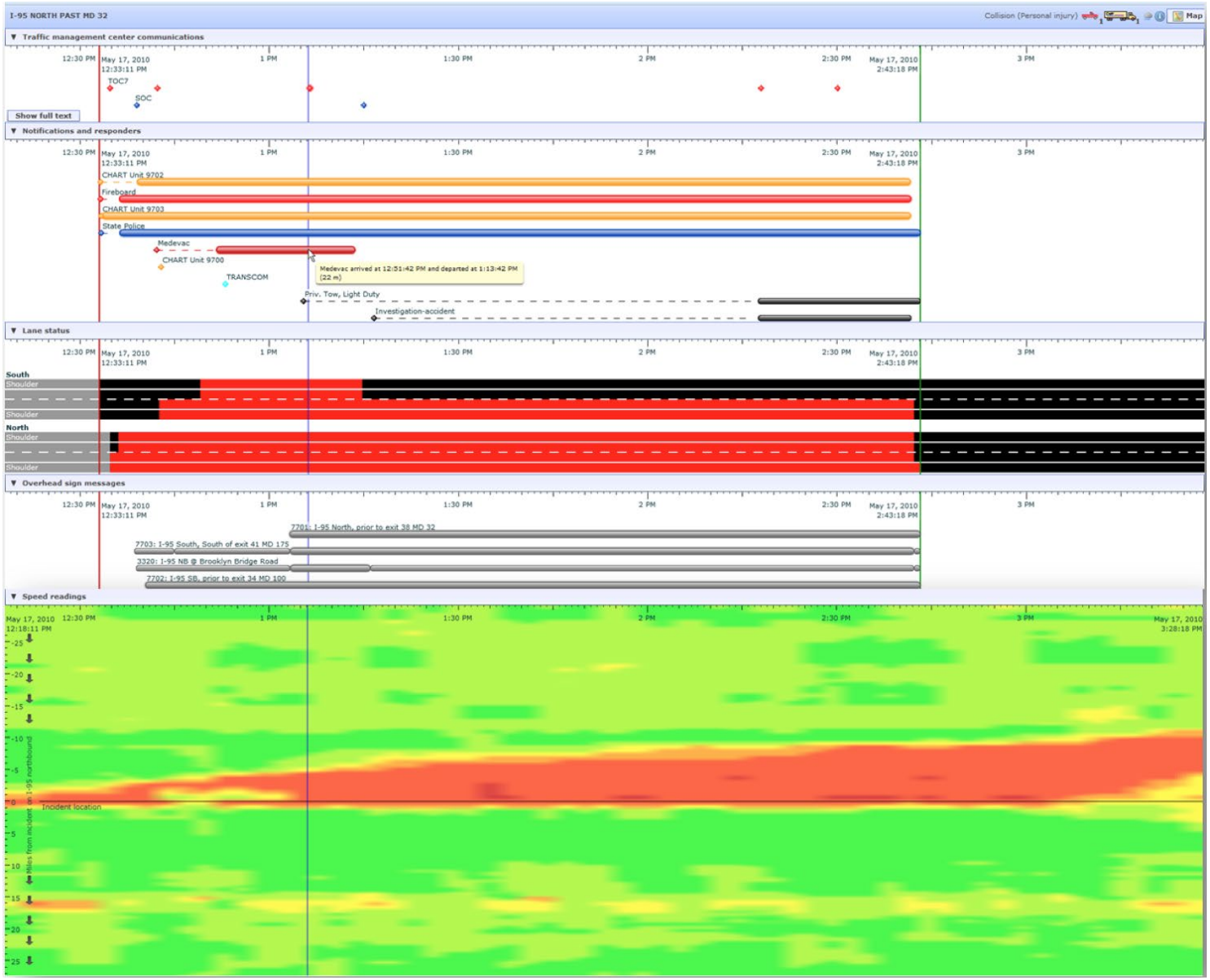


Figure 3-1 *RITIS Chat screenshot*

The event timeline, when available, contains a multitude of information time-stamped throughout the manifestation of the incident. The "Notification and Responders" area shows when different agency responders were at the incident site. The "Lane Status" area shows which lanes and shoulders were blocked at which times. The "Overhead Sign Messages" area show which dynamic message signs (DMS) were active and the messages they displayed regarding the incident. The Speed Reading area shows the average speed of traffic in proximity of the incident.

Figure 3-2

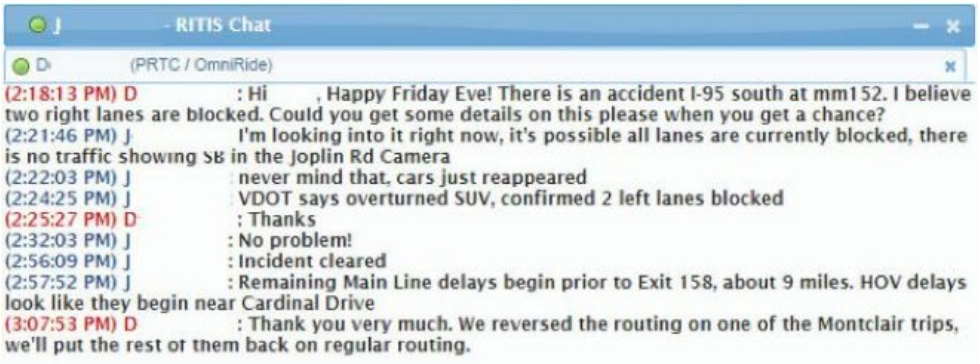
PRTC event timeline



Upon viewing the event timeline, the PRTC operator contacted MATOC via the RITIS Chat tool. Figure 3-3 is a screenshot of the chat log.

Figure 3-3

RITIS Chat log between MATOC (J) and PRTC (D)



PRTC used the information obtained through the chat session to reroute one of its buses. Note that the MATOC operator (J) also used a traffic camera feed made accessible through RITIS.

The next example took place during the Ebola scare that occurred adjacent to the Pentagon affecting major bus operations at the Pentagon Transit Center. On October 17, 2014, just after 9:00 AM, a woman who had just returned from Africa displayed symptoms of the Ebola virus. Authorities closed off access to most of the Pentagon as a precaution [8]. Figure 3-4 shows the resulting RITIS Chat log.

PRTC used the RITIS Chat tool to ask MATOC operators about the status of road closures around the Pentagon. The MATOC operators were able to update PRTC since the operators had been corresponding with Washington Headquarters Services (WHS) and the Pentagon Force Protection Agency (PFPA).

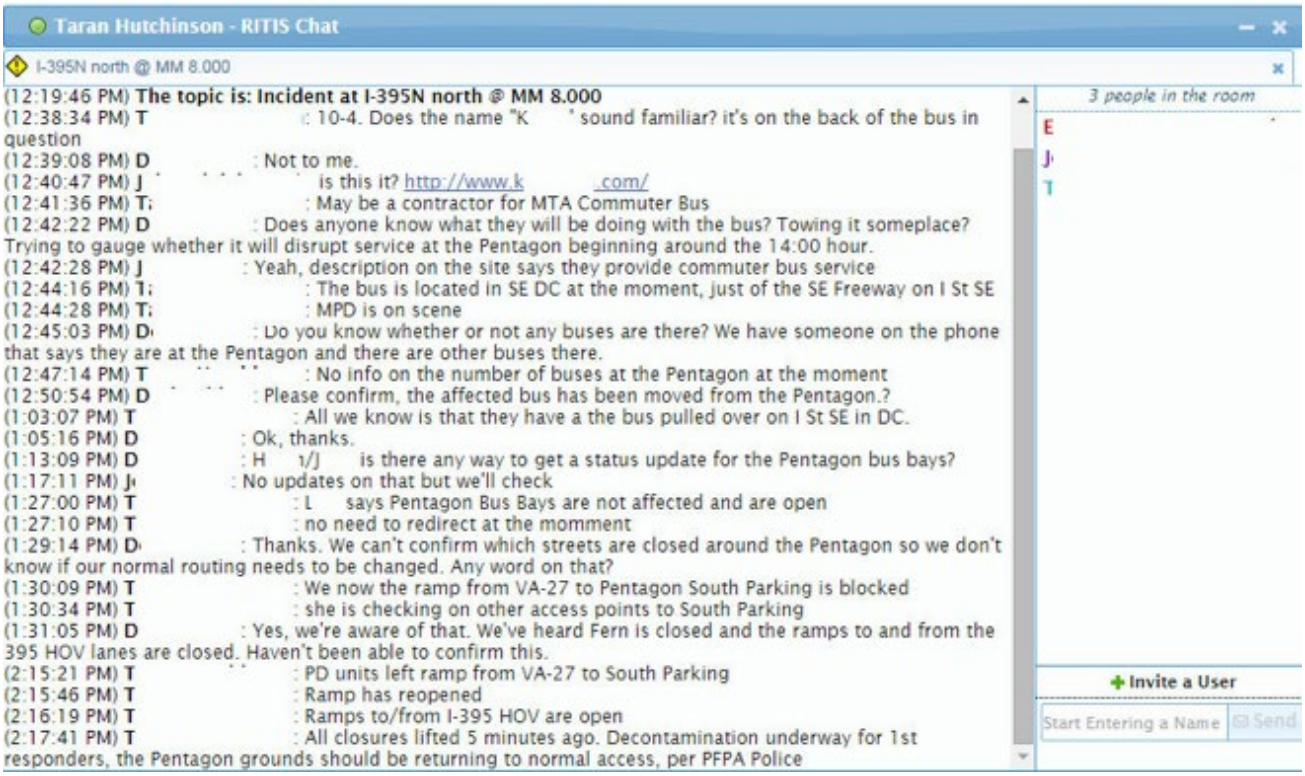


Figure 3-4 *RITIS Chat log of Ebola scare*

Transit System Data Integration

Transit System Data Integration was enabled in August 2012. Prior to then, RITIS users only had the option of showing a "Metro Routes" layer. With the transit enhancements made through this project, a "Public Transit" layer is now available. The "Metro Routes" layer, as shown in Figure 3-5, shows the location of all six lines of the WMATA Metrorail system and its 91 stations.

The "Public Transit" layer has the capability to show individual bus routes (as selected by users), bus stops, and buses, as shown in Figure 3-6.

Currently, Montgomery County's Ride On and Arlington Transit (ART) have opted to provide their bus network information, but they have not included their bus location feed. The CATT Lab anticipates working with other NCR transit agencies to incorporate transit data into RITIS.

Figure 3-5

RITIS Metro routes layer

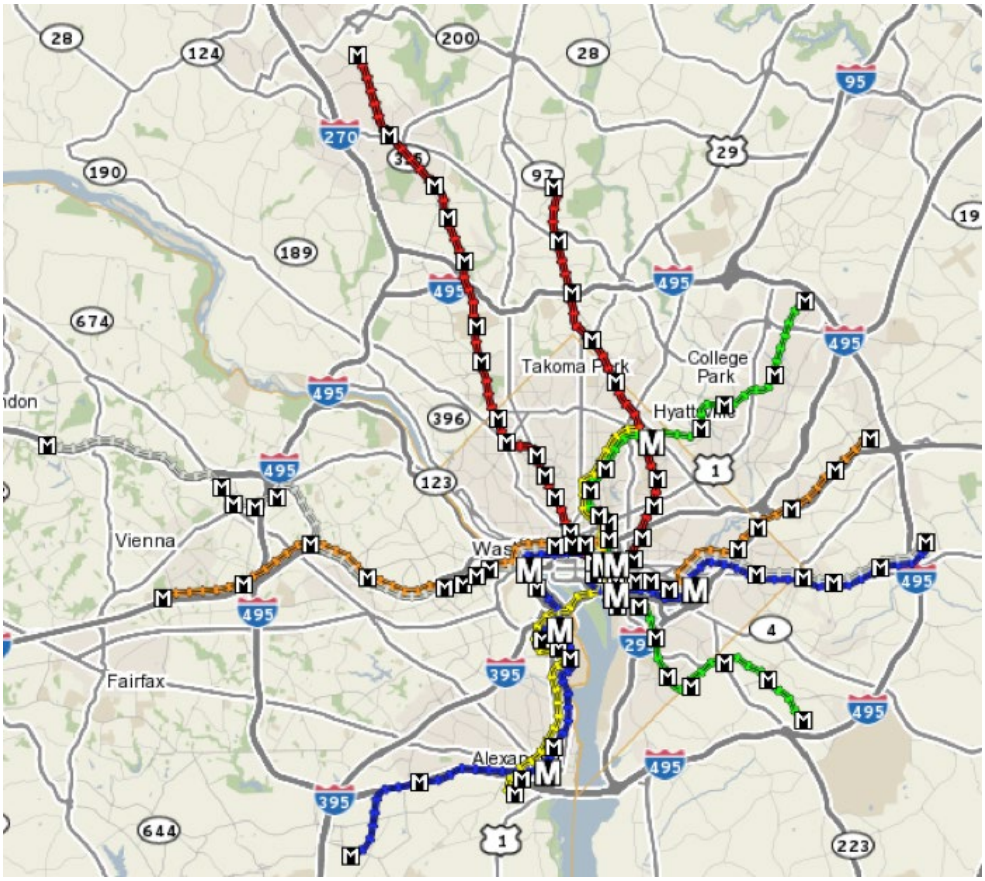
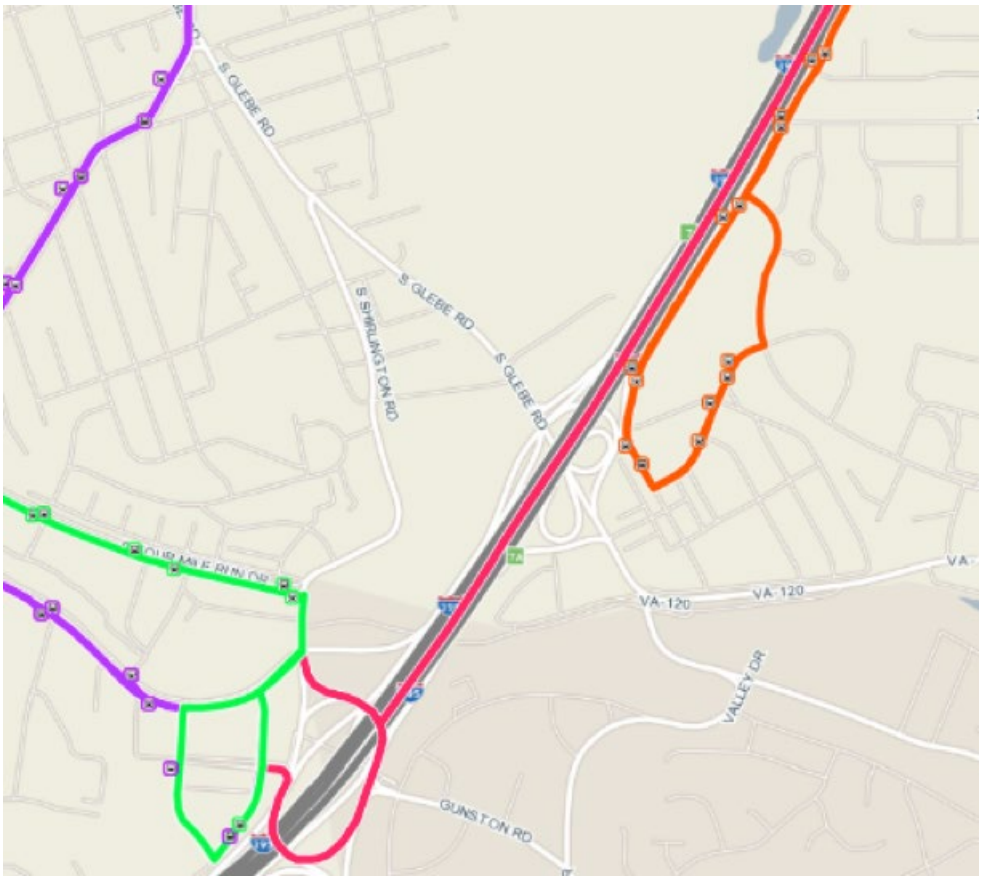


Figure 3-6
RITIS transit layer



Evaluation

The last part of the project was to develop an evaluation report summarizing the benefits of the IM and Real-time Transit Data tools. The evaluation looks into how the tools affect specific agency actions, change operator satisfaction levels, facilitate interagency communication, and affect incident notification times.

SECTION 4

Evaluation Activity

Setup

MATOC and CATT created a simulated unplanned event to test and evaluate the RITIS Chat feature with participants. The MATOC Transit Task Force (TTF) asked agencies for volunteers to participate in the simulation. Table 4-1 shows the list of participants.

Table 4-1

Summary of Agencies Participating in Evaluation

Agency	Function	Key Statistics
Center for Advanced Transportation Technology (CATT) [9]	Transportation research group within University of Maryland	Contains six major initiatives within organization
Metropolitan Area Transportation Operations Coordination (MATOC) [10]	Partnership of transportation agencies within NCR; housed within CATT	Estimated annual benefits of direct MATOC action calculate to $12.9 million in mobility savings, including greenhouse gas savings of $500,000+
Potomac and Rappahannock Transportation Commission (PRTC) [11]	Multi-jurisdictional transportation agency for Virginia municipalities located 25 miles southwest of Washington DC	135 buses (2013), 3.2 million passengers (2013), 15 commuter bus routes (2014), 7 local bus routes (2014)
Washington Headquarters Services (WHS, Department of Defense) [12]	Essential service provider for U.S. Department of Defense and Office of the Secretary of Defense offices in NCR	Operates a 14-route shuttle bus system for authorized personal

Representatives from MATOC both facilitated the activity and simulated a MATOC facilitator and operator throughout the exercise. CATT provided personnel to facilitate question-and-answer discussions before and after the simulated event as well as the final analysis for the evaluation. PRTC and WHS volunteered representatives who manage day-to-day operations during normal and unusual circumstances. The participants communicated via teleconference and Adobe Connect through the entire session. The RITIS Chat tool was available during the simulated event. The session was recorded to assist in recapping the meeting.

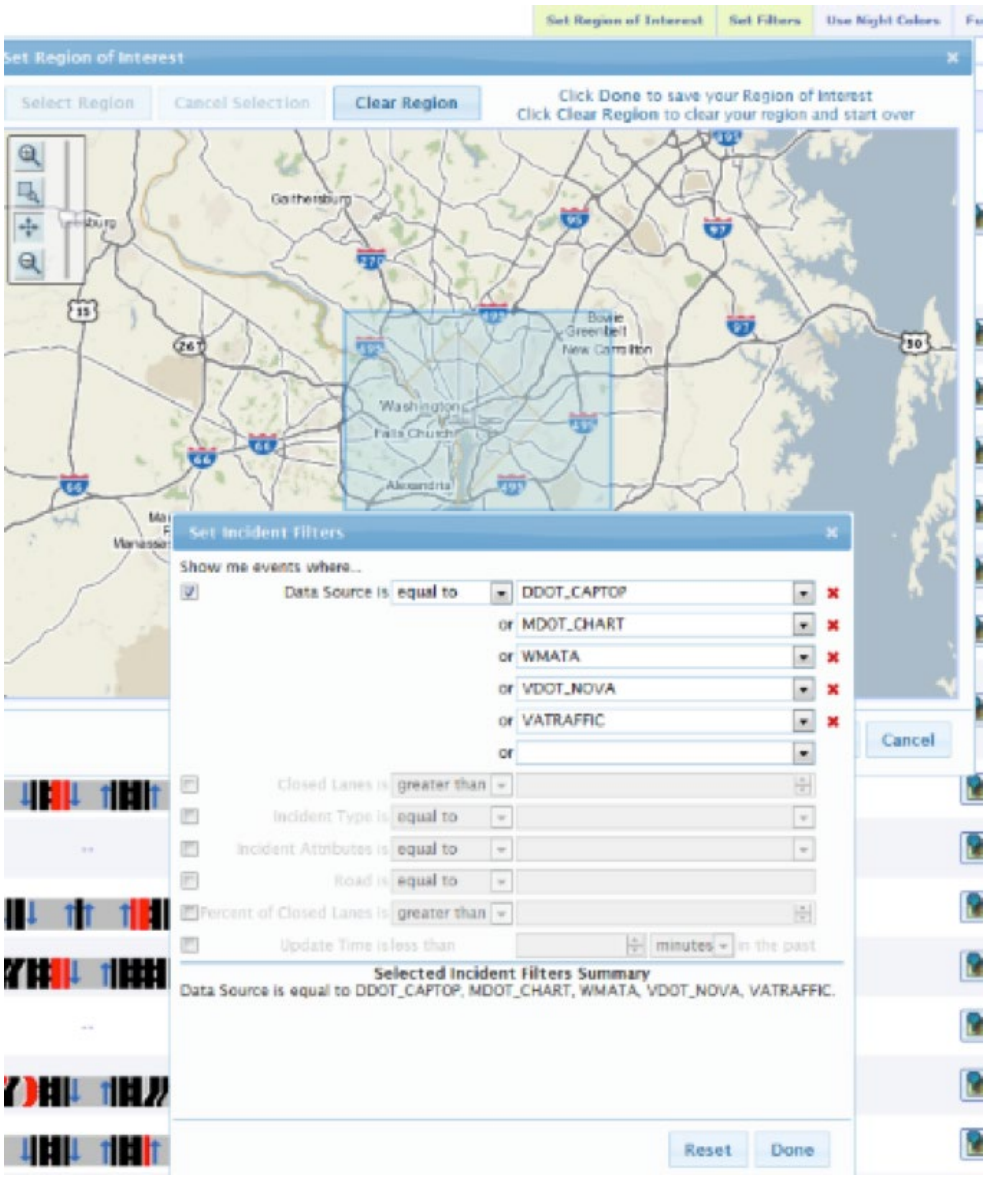
RITIS Tutorial

Most participants had at least some familiarity with RITIS and the chat function, and MATOC personnel provided other participants with a short RITIS tutorial. Volunteers were instructed on the following:

- How to set incident filters that constrain the incidents listed so only pertinent incidents in the NCR are shown. The "Set Region of Interest" feature can be used by users to point and click a box on top of a map. Incidents outside the geographic area constrained in the box are not included in the customized RITIS incident feed. The "Set Incident Filters" box allows users to check off which data sources, incident types, and other incident features are to be included/excluded in their incident feed. Figure 4-1 is a screenshot of the "Set Region of Interest" and "Set Incident Filters" menus.

Figure 4-1

Set Region of Interest and Set Incident Filters menus



- The incident list, as shown in Figure 4-2, displays all the incidents that pass through the user's filter. This list includes many attributes for each incident, such as the time of the last update, a graphic that shows which lanes are open at the incident, and access to the incident chatroom and timeline.

Figure 4-2 *Incident list*

- How to pan around the traffic map, activate the map legend, and use the "My Location Button."
- Map layers, shown in Figure 4-3, shown in detail, including:
  - Traffic cameras, which let RITIS users view live traffic camera video feeds.
  - Radio scanner, which allows RITIS users to listen in on other agency radio feeds.
  - Fleets layer, not available yet to all RITIS users, which shows where AVL-equipped vehicles in agency fleets are located.
  - What is available on the public transit layer and what could be shown with public transit agency data feeds with additional transit agency participation.
  - Probe speed data and the types of speeds that can be shown (speed, comparative speed, etc.).
  - How to order layers to make more important layers display on top.
  - Toggle between day and night mode, which can be used to provide better visibility when there is limited light, and full screen mode, which can be used on large single use monitors.

Figure 4-3
RITIS map layers

- RITIS Chat and its features, including:
  - Activating RITIS Chat (active only if a user sets it as active)
  - How to have one-on-one conversations
  - Setting RITIS Chat status
  - Getting into an incident-specific chatroom
  - Inviting users into chatrooms
  - Searching for other users

Pre-Activity Questions

CATT asked the agency volunteers several questions regarding how they operate and their exposure to RITIS. The following is a summary of the pre-activity questions.

How does your agency communicate within your agency?

PRTC: The PRTC Director of Customer Service & Dispatch will call in other managers during a large event by phone if additional manpower is needed for detours. Dispatchers are contacted either by phone or in person, and drivers are contacted by dispatchers through radio.

WHS: WHS uses phone calls and email to reach facility and transit managers, and email or text alerts to customers if there are delays or other unusual circumstances.

How does your agency communicate with other agencies?

PRTC: PRTC generally does not communicate extensively with other agencies; however, the RITIS Chat feature could be used for that purpose. PRTC does not have issues finding the right people to contact, but at times has trouble contacting people outside the agency. It uses the phone, email, or RITIS Chat to communicate with MATOC to get more information. It would like a way to have the latest contact information such as mobile phone numbers for people in other agencies, whether it is through RITIS or another medium. The MATOC–TTF contact list has been a good source for contact information.

WHS: WHS already has specified points of contact (POCs) for specific plans. Because of its procedures, the first step during information gathering is contacting POCs. WHS uses RITIS as a supporting tool to notify it if an incident is occurring. Often, WHS is not immediately contacted by other partner agencies/contractors if an incident is with them. In that case, WHS uses RITIS to notify it that it needs to contact the other agency/contractor through a designated POC for more information and coordination.

Within your agency, who handles the top-level communication during incidents?

PRTC: The PRTC Director of Customer Service & Dispatch handles communications within PRTC and contract operators. The Manager of Planning and Quality Assurance gets involved if the incident is large and contacts other agencies if necessary.

WHS: There are multiple designated staff within WHS who provide top-level communication and coordination during incidents. WHS communication is dependent on the nature of the incident. Since some WHS routes are contracted, there are designated people who communicate for those services.

What information is passed on?

PRTC: PRTC starts with identifying what the incident is and where it occurs. It uses the RITIS incident timeline to assess the seriousness of the incident. This information is then passed to dispatchers who can analyze how the incident impacts their routes, if at all. PRTC will then notify drivers to help them work around problems. PRTC reaches out to MATOC to get more information about incident timelines such as when a service disrupting incident is anticipated to clear.

WHS: WHS inquires about the incident overview, its impact, anticipated clearance time, and ramifications such as delays and uses this information to inform customers and service operators.

How long does it take for information to travel across the chain of communication?

PRTC: PRTC acts within minutes. It first notifies drivers who will get to the incident first through the dispatcher. PRTC will soon have the capability to send out alerts digitally through a mobile data terminal (MDT).

WHS: WHS notifies the designated POC within 5–10 minutes after receiving information regarding the incident. This is also done concurrently with other operations.

Does your agency use RITIS and/or coordinate with MATOC? If so, how?

PRTC: PRTC both receives information from and provides information to RITIS and MATOC. In the future, once its Computer-Aided Dispatch (CAD) AVL system is running, PRTC hopes to passively provide its bus information to RITIS. PRTC also is working with MATOC to directly receive the RITIS incident Rich Site Summary (RSS) feed into the PRTC dispatching incident queue.

WHS: WHS uses RITIS primarily to gather information, which is provided to WHS customers and operators.

How does your agency receive information for no-notice and preplanned events?

PRTC: PRTC scans different information sources for pre-planned events, including direct customer feedback and traffic cameras. PRTC hopes that the centralized information MATOC provides will become the primary source for

pre-planned event notification and information. No-notice event information can come from anywhere.

WHS: WHS gets monthly notices of pre-planned events from events and communication offices and assesses if the events will impact its customers. Service providers also inform WHS of events. For weather-related events, it monitors the Office of Personnel Management (OPM) for closure information. WHS finds the RITIS alerts very helpful during inclement weather, especially for determining when weather events will happen and their anticipated affects.

Event Simulation

The MATOC and CATT staff used a series of PowerPoint slides and narratives to simulate the time-lapsed event to the agency volunteers. The following is a summary of the simulated event. The full series of slides is shown in Appendix A.

Location (Slide 6)

The simulated event occurred at the interchange of I-395 and Seminary Road in Alexandria, Virginia, adjacent to the Mark Center. The site was chosen because all the volunteering agencies have multiple services going through this interchange.

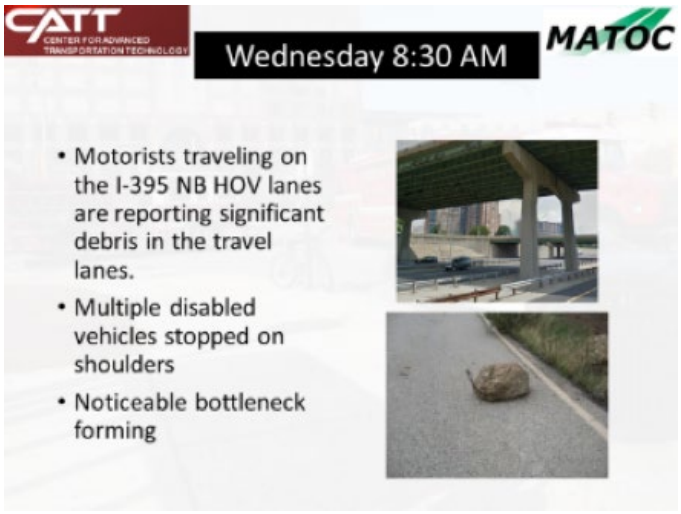
Figure 4-4
Slide 6 – Incident location

Wednesday 8:30 AM (Slide 7)

The incident begins towards the end of a Wednesday morning rush hour. Since this incident was simulated, MATOC used a nearby construction zone incident to set up a chatroom for the exercise. Once all the participants joined the chatroom, the MATOC facilitator began the activity by showing slide 7. The slide showed motorists using I-395 High Occupancy Vehicle (HOV) lanes, set in the northbound direction, reporting debris in their lanes. Many vehicles are stopped on the shoulders, and a bottleneck is forming.

Figure 4-5

Slide 7 – Incident start

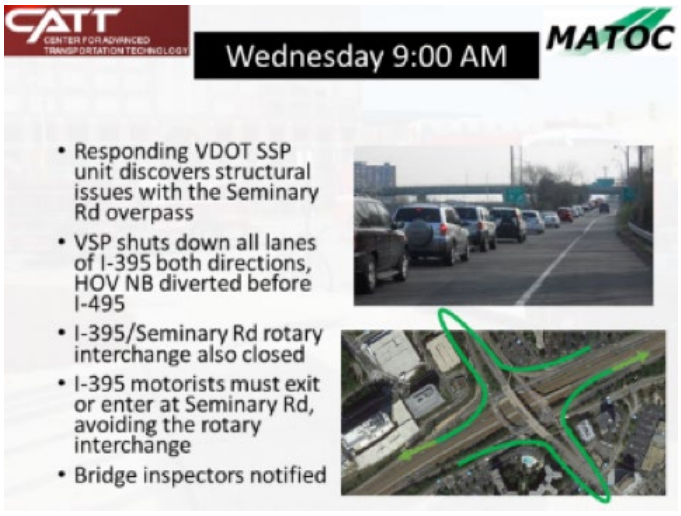


Wednesday 9:00 AM (Slide 8)

The MATOC facilitator (operator) via RITIS Chat notifies the participants that the VDOT Safety Service Patrol (SSP) found structural issues with the Seminary Road overpass and shut down all lanes of I-395, the Seminary Road overpass, and the rotary interchange. The bridge inspector was notified. One of the PRTC volunteers explains by voice that at 9:00 AM, the majority of its morning commuter buses have already passed and that they have several hours before their noon bus services, but PRTC still needs the status on the HOV lanes within 1.5 hours to decide how they will operate their noon and afternoon service. PRTC would be asking MATOC for more information on when the HOV lanes will be restored. WHS asked via chat if there was a local detour available.

Figure 4-6

Slide 8 – Incident notification, Wednesday 9:00 AM



Wednesday 10:00 AM (Slides 10 & 11)

The MATOC facilitator conveyed that the initial bridge inspection revealed that the Seminary Road overpass has weakened rebar and a punctured bridge deck. VDOT opened the I-395 main line lanes and the Seminary Road rotary interchange, but the HOV lanes and Seminary Road overpass will remain closed for at least 36 hours for temporary repairs. HOV lane access is limited to before I-495 when the HOV lanes are in the northbound configuration and at Turkeycock Gates when the HOV lanes are set to the southbound configuration.

PRTC asked via RITIS Chat if the HOV will be configured in the southbound direction during Thursday's morning rush hour. It also indicated that it would be running emergency service out of the Franconia–Springfield Metro Station instead of going into the District of Columbia. PRTC said that if they were presented the above information, they would act quickly to notify customers of emergency service operations. The MATOC operator answered via RITIS Chat that south of Turkeycock, the HOV lanes will remain in the southbound direction, but the HOV lanes north of Seminary Road will be configured northbound during Thursday morning's rush hour. The WHS volunteer indicated that WHS would be monitoring conditions and notifying customers. The volunteer also asked the MATOC facilitator if MATOC would give regular updates, which the facilitator confirmed. One of the PRTC volunteers added how PRTC appreciates how RITIS Chat can be used to get real-time information and give status updates instead of waiting for hourly reports.

Figure 4-7

Slide 10 – Incident update, Wednesday 10:00 AM

Figure 4-8

Slide 11 – Incident update, Wednesday 10:00 AM

Wednesday 3:00 PM (Slide 12)

The MATOC facilitator reported that I-395 has heavier-than-normal congestion in both directions near Seminary Road, and the HOV lanes are open southbound from Turkeycock Gates but are still closed between Turkeycock Gates and Seminary Road. WHS indicated that, in this circumstance, it would like status updates to be able to manage its services and notify its customers. PRTC would want to know if HOV restrictions were lifted. The group as a whole discussed whether OPM would have a plan to release federal workers early. The MATOC facilitator asked the agency volunteers if any of the new information would affect their plans currently in place. PRTC mentioned that it would contact WMATA and Fairfax Connector to tell them to expect more PRTC activity around the Franconia–Springfield Metro Station. PRTC normally uses a phone call to contact the other transit agencies but would use RITIS Chat if the other agencies were online.

Figure 4-9

Slide 12 – Incident update, Wednesday 3:00 PM

Thursday 8:00 AM (Slide 14)

The participants were notified that this event has received a lot of press coverage. Alternate routes around the closure have heavier-than-normal congestion. The MATOC operator communicated via RITIS Chat that the closure will be in effect until 8:00 PM, two hours earlier than anticipated.

Figure 4-10

Slide 14 – Incident update, Thursday 8:00 AM

Thursday 12:00 PM (Slide 15)

The MATOC operator notified the agency volunteers through RITIS that the emergency repairs were complete and repair crews were working to clean up the site. The HOV facility will be opened by 2:00 PM, but permanent repairs will necessitate off-peak closures. PRTC said that once it got an absolute confirmation that the HOV lanes would be opened, it would restart normal operation.

Figure 4-11

Slide 15 – Incident update, Thursday 12:00 PM

Simulation Closing Items

The participants briefly discussed a few items after the exercise. The agency participants indicated that they would like a mobile version of the RITIS Chat tool because during an emergency, operations may not be at a desk. They also would like automatic incident updates. PRTC told the group that it had used RITIS Chat in the past and it worked well to pass information to MATOC. It was brought up that in an emergency situation, it is difficult to dedicate time to a phone call. It is much easier to use RITIS Chat, especially when multi-tasking.

Post-Activity Questions

What problems did you face during the scenario?

PRTC wanted to know as soon as it was determined how long the closure would be in affect and the nature of the closure. MATOC emphasized that the incident timeline can be used to learn incident-related information, but the amount of detail put in for that incident varies agency to agency.

Did the RITIS Chat feature make responding to the event easier?

PRTC was satisfied with the Chat feature. Based on this exercise, WHS will consider using the Chat feature to give pertinent information to MATOC.

What type of enhancements to the RITIS Suite would have made your job easier in the scenario?

A mobile version of the RITIS Chat feature would help users use the feature wherever they are deployed during an emergency. An audio and or visual alert that tells the user there has been an incident update would minimize the amount of time they have to check RITIS. There were some stability issues with the Chat tool. The ability to add documents or pictures to the RITIS Chat room would help users pass and assimilate information to one another. The group also discussed how a more up-to-date RITIS address book would help incident responders reach the correct people. Since weather events are a regional incident, there should be an option for a region-wide weather-related chatroom.

Was this type of simulation helpful for getting experience using RITIS and the Chat tool?

All parties found the activity useful.

Would you recommend doing this type of low-fidelity simulation in the future?

The participants agreed that occasionally having an exercise reminds people of the current RITIS tools. This exercise also exposes MATOC to the type of information participating agencies need.

General Evaluation Observations

Overall, the agency participants were satisfied with RITIS Chat. They indicated that they currently use the feature and would like more agencies within the NCR region to adopt RITIS Chat. In particular, RITIS Chat would enable better and timelier communication, which would lead to better coordination and collaboration in a special-event scenario. The enhancements mentioned in the post-activity question section would further RITIS and its mission to provide situational awareness.

SECTION 5

Conclusion

The chatroom feature and transit enhancements were successfully built into RITIS by the CATT Lab. As shown by the simulated event (as well as the additional anecdotal incident examples provided in the report), RITIS can improve interagency communication, decrease incident notification times to agency operations staff, and improve operator satisfaction. The transit layers have the capability to give both transit and MATOC operators a better grasp of the current status of the NCR's transit systems, allowing the operators to better respond to service disruptions. Better responses to service disruptions would improve rider experience with more reliable transit journeys, as exemplified in the example in which PRTC rerouted a bus to avoid incident-related delays. The greater availability of transit data through RITIS will allow transit operators to better coordinate services. Coordinating services will allow transit agencies to maximize resource utilization and improve transit services for riders. The improved transit experience has the potential to increase transit ridership.

The benefits of the transit-related enhancements and RITIS Chat features will be realized fully when the transit agencies around the NCR provide RITIS with their data feeds and if they use the RITIS toolset, including the new Chat feature. Users and operators stand to benefit when RITIS is fully used, but the benefits will be only to the agencies that use RITIS. Based on discussions at MATOC TTF meetings, additional transit agencies soon will start providing their data feeds to RITIS and have already been using RITIS for their day-to-day operations. While day-to-day use is not currently enough to help reach the MATOC TTF's ambitious goal of improving transit user experience and operator satisfaction throughout the NCR, MATOC staff and the TTF will continued to strive towards full adoption of RITIS by all transit agencies.

There are many potential opportunities to build upon this project that could be easily addressed through various other programs or with additional federal funding. Many of the suggested RITIS enhancements brought up from the evaluation exercise are technically feasible for the CATT Lab to implement and agencies to use. Outreach to encourage MATOC TTF participation and RITIS adoption from the other NCR transit agencies can be conducted by active MATOC TFF members. Additional simulation exercises to facilitate discussion among all agencies who participate with MATOC and/or use RITIS also can be organized with additional much effort.

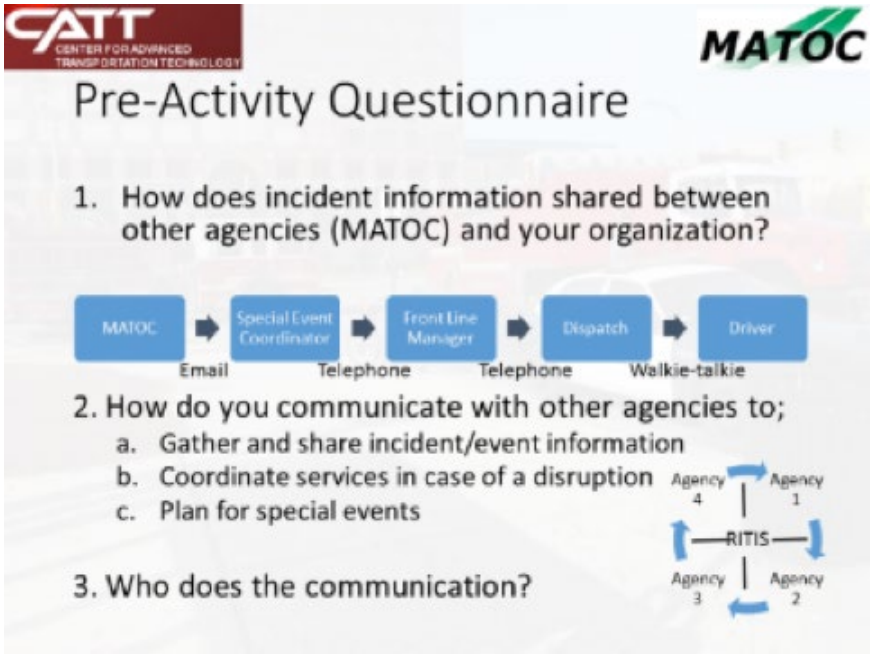
APPENDIX

A

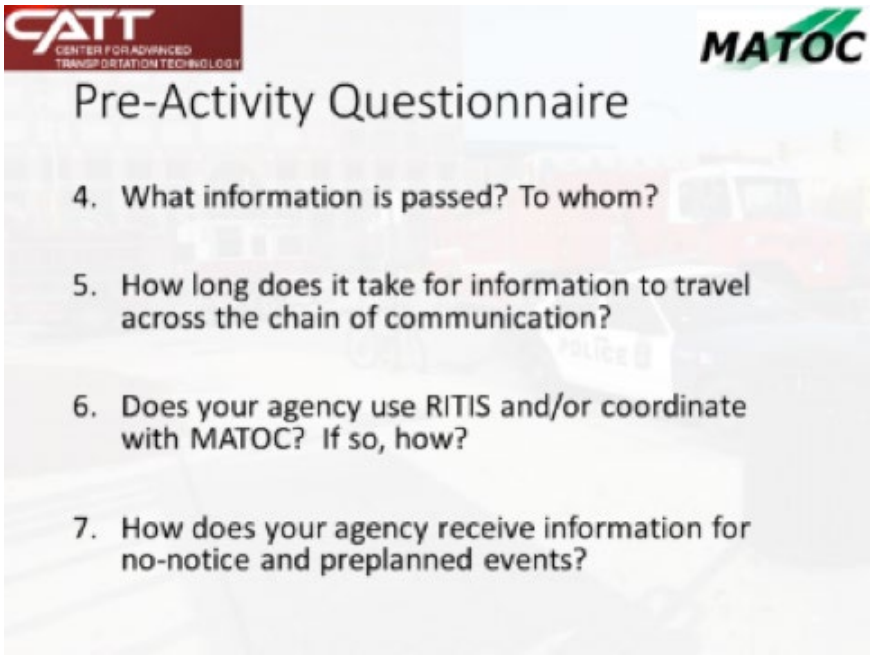
Simulation Exercise Slide Presentation

Slide 1

Slide 2



Slide 3

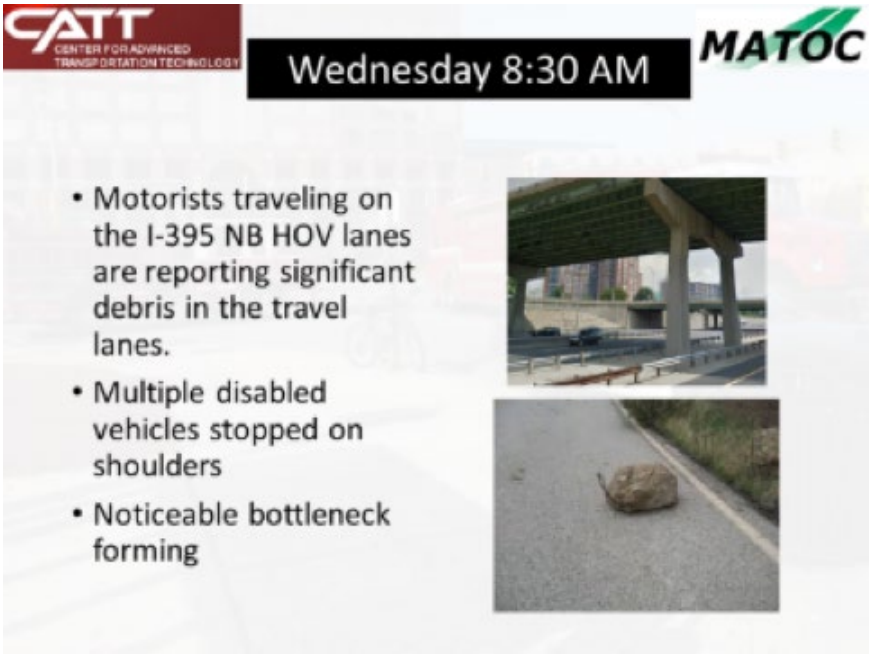


Slide 4

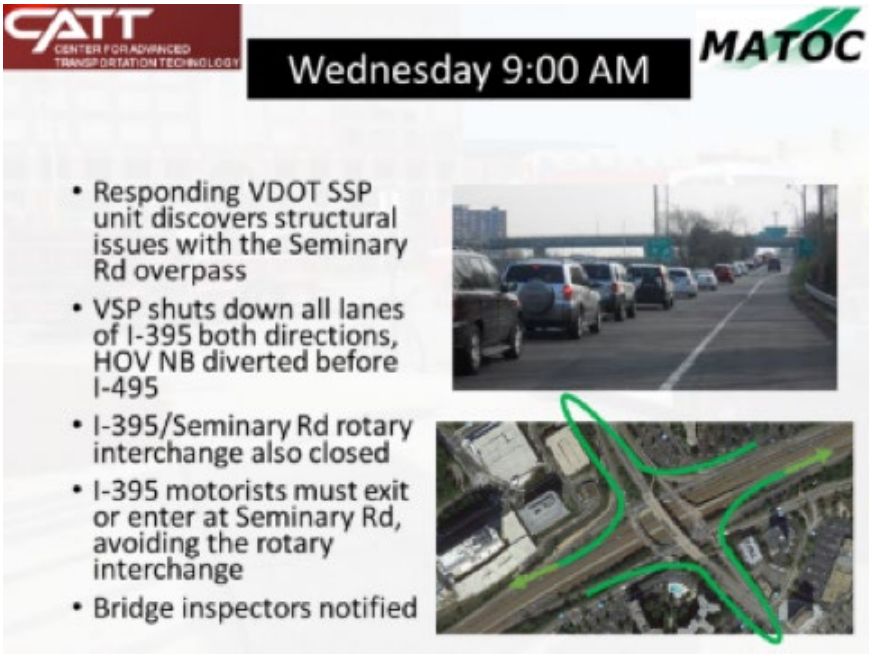
Slide 5

Slide 6

Slide 7



Slide 8

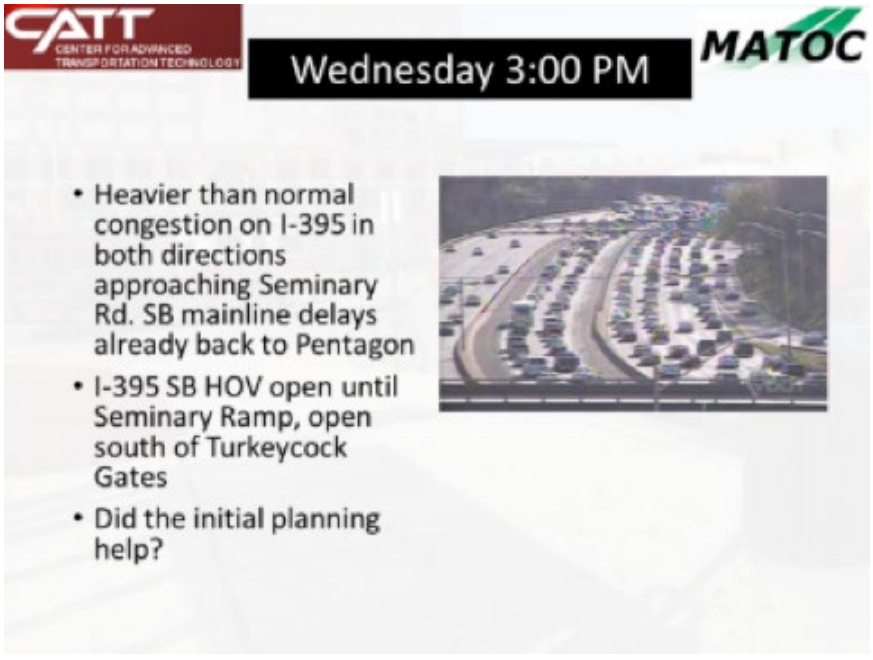


Slide 9

Slide 10

Slide 11

Slide 12



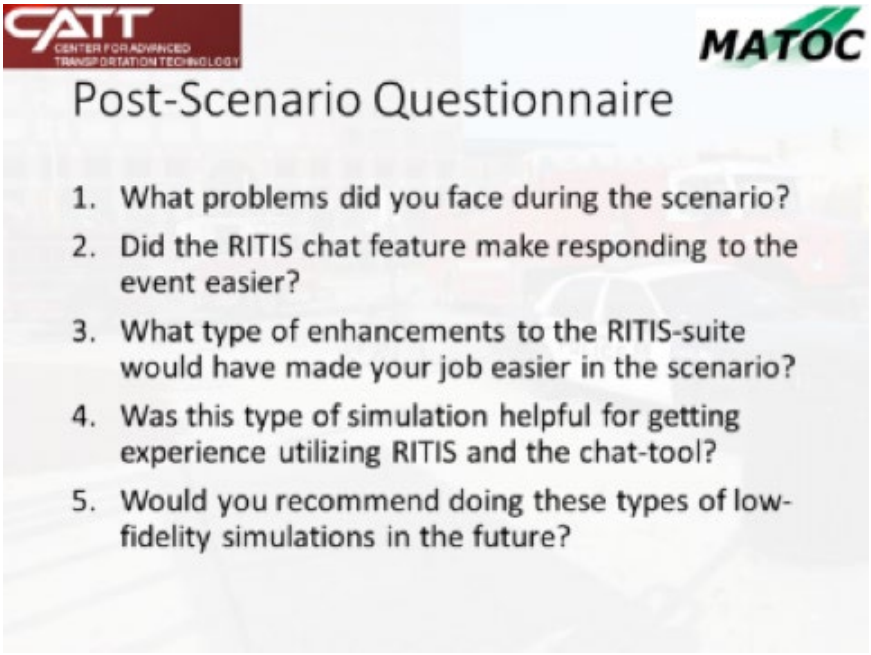
Slide 13

Slide 14

Slide 15

Slide 16

Slide 17


CATT
CENTER FOR ADVANCED TRANSPORTATION TECHNOLOGY
MATOC
Post-Scenario Questionnaire
1. What problems did you face during the scenario?
2. Did the RITIS chat feature make responding to the event easier?
3. What type of enhancements to the RITIS-suite would have made your job easier in the scenario?
4. Was this type of simulation helpful for getting experience utilizing RITIS and the chat-tool?
5. Would you recommend doing these types of low-fidelity simulations in the future?

APPENDIX

B

Activity RITIS Chat Log

(11:24:43 AM) The topic is: Construction Work at VA-420E east @ MM 0.300

(1:56:09 PM) MATOC Instructor: Exercise Exercise Excercise

(1:56:23 PM) MATOC Operator: *EXERCISE* VDOT SSP unit discovered a structural issue with Seminary Rd overpass.

(1:56:44 PM) WHS: Is the detour plan available? Trying to assess traffic impact to the Mark Center.

(1:57:04 PM) MATOC Operator: VSP has shut down all lanes on I-395 in both directions as well as HOV NB diverted before I-495

(1:57:25 PM) MATOC Operator: I-395 motoros must exit or enter at Seminary Road avoiding the rotary interchange.

(2:00:29 PM) MATOC Operator: VDOT is estimating repairs to last for 36 hours (Thursday 10 PM)

(2:01:44 PM) MATOC Operator: I-395 main lanes are open. I-395 NB HOV will be blocked from Beltway to Seminary Road, HOV SB lanes will be open at Turkeycock gates.

(2:03:25 PM) PRTC: Will the HOV lanes be operating in the southbound direction in tomorrow AM as well? We will likely operate ESP out of the Metro stations for the afternoon.

(2:04:47 PM) MATOC Operator: The HOV will be SB starting at Turkeycock gates until closures are lifted.

(2:05:15 PM) MATOC Operator: The HOV NB will only be open after Seminary Rd in the morning

(2:13:20 PM) MATOC Operator: Wednesday 3PM - HOV lane closures are still in place as previously stated.

(2:15:36 PM) MATOC Operator: Closures are still expected to last until Thursday 10PM.

(2:20:40 PM) MATOC Operator: Thursday 8AM - VDOT advises closures expected to last until Thursday 8PM, 2 hours ahead of scheduled.

(2:22:00 PM) MATOC Operator: Thursday 12PM - VDOT says closures are well ahead of schedule. All closures expected to open at 2PM.

(2:38:01 PM) MATOC Instructor: VDOT confirms that lanes will be available at 2pm

(2:42:32 PM) MATOC Operator: Thanks for participating in the exercise!

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