Prototype Development and Demonstration for Response, Emergency Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)

Information Broker Framework Analysis

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16. Abstract

Through the Dynamic Mobility Applications (DMA) Program, U.S. DOT desires to improve current operational practices and transform management of future surface transportation systems. The DMA program is designed to enhance deployment of emerging technologies and applications and promote collaboration in research and development (R&D) of the transformative mobility applications that emerge from this process. Response, Emergency, Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.), is one component of the DMA program. Emergency Communications for Evacuation (EVAC) is one of three complementary applications that composes R.E.S.C.U.M.E. This document provides an analysis of the Regional Integrated Transportation Information Systems' (RITIS) and CapWIN's ability to serve as an Information Broker that is conceptualized to support various functions of R.E.S.C.U.M.E., in particular the EVAC application. In addition, it provides guidance on minimum functions that are required to enable the Information Broker and EVAC application in other regions nationally.

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Chapter 1 Introduction

Through the Dynamic Mobility Applications (DMA) Program, U.S. DOT desires to improve current operational practices and transform management of future surface transportation systems. The DMA program is designed to enhance deployment of emerging technologies and applications and promote collaboration in research and development (R&D) of the transformative mobility applications that emerge from this process. The DMA Program's current phase involves application prototype development and testing, and coordinated research activities on a portfolio of selected high-priority mobility applications. Response, Emergency, Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.), is one component of the DMA program. R.E.S.C.U.M.E. is composed of three complementary applications:

1. Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE),
2. Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG), and
3. Emergency Communications for Evacuation (EVAC).

The INC-ZONE and RESP-STG applications have been selected for prototype development and testing based on their potential to capitalize on existing technology and ongoing advances and ability to transition through development, testing, simulation, and potential for regional deployments. While there is a recognized need to enhance evacuation operations, the EVAC application currently is not being prototyped due to a number factors, including the level of planning and institutional coordination among a range of different disciplines required at multiple levels of government, and the funding required to enhance existing infrastructure and integrate systems owned and operated by multiple agencies.

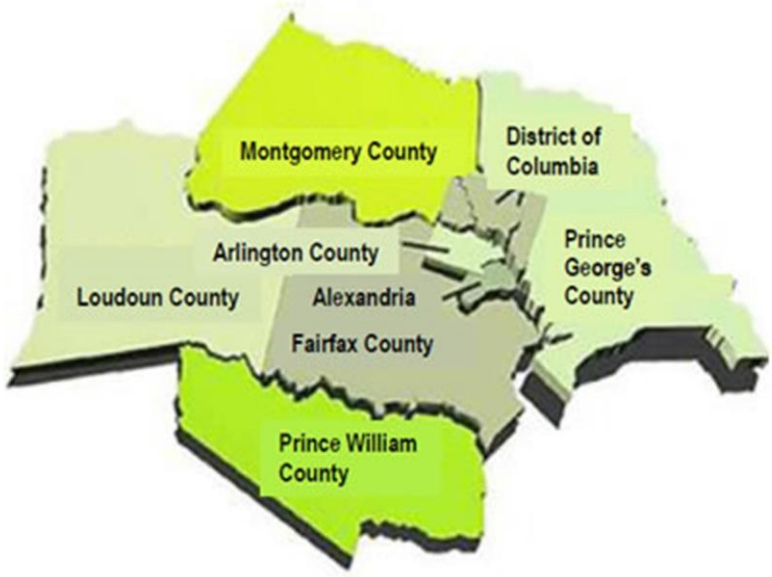
This document provides an analysis of the capability of the Regional Integrated Transportation Information Systems (RITIS) and Capital Wireless Information Net (CapWIN) to serve as an Information Broker that is conceptualized to support various functions of R.E.S.C.U.M.E. Specifically, the document focuses on the functions needed to enable the Emergency Communications for Evacuation (EVAC) application of R.E.S.C.U.M.E. As described in the R.E.S.C.U.M.E. Concept of Operations[1], the Information Broker is an automated data collection, sharing, dissemination, and archiving system that provides a range of tools to support regional transportation operations during both emergency and non-emergency operations. It is intended to facilitate information sharing between a range of stakeholders at multiple levels of government and private sector entities that provide services to the traveling public. Further, the Information Broker and EVAC application are intended to support the travel service needs of those able to evacuate themselves (e.g., route guidance, food, fuel, lodging) as well as those who are unable (e.g., ride-matching, shelter-matching and medical services).

[1] Response, Emergency Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.) Concept of Operations – Final Report. November 19, 2012.

RITIS is administered by the Center for Advanced Transportation Technologies at the University of Maryland and supports transportation operations in the District of Columbia, State of Maryland and Commonwealth of Virginia. However, for the purposes of this report, the focus will be only on the National Capital Region (NCR).[2] Figure 1-1 provides a map of the jurisdictions included in the NCR.

RITIS does not operate in a vacuum within the NCR, however. It heavily leverages CapWIN, which is a communications-based, information sharing system designed for gathering and disseminating information within the NCR. Together RITIS and CapWIN have the potential to address the functionality required by the R.E.S.C.U.M.E. Information Broker EVAC functions.

The framework builds upon the Concept of Operations and high-level functional requirements that have previously been defined for R.E.S.C.U.M.E.[3] and applies them to the unique operational environment in the NCR. This document also provides an analysis of the various systems and functions of the conceptual EVAC functions of the Information Broker that currently do not exist within RITIS.



Source: Federal Highway Administration

Figure 1-1. Jurisdictions included in the National Capital Region

[2] The National Capital Planning Act of 1952, 40 USC 71. defines the NCR as the District of Columbia; Montgomery and Prince George's Counties in the State of Maryland; Arlington, Fairfax, Loudon, and Prince William counties in the Commonwealth of Virginia; and all cities existing in Maryland or Virginia within the geographic area bounded by the outer boundaries of the combined area of these counties.

[3] Prototype Development and Demonstration for Response, Emergency Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.) Final Functional and Performance Requirements. January 10, 2014.

It is important to note that the analysis contained in this report serves as an example and is tailored to the specific operational environment, institutional structures and infrastructure in the NCR. It is recognized that significant investments have been made in the NCR to establish a level of maturity that lends itself to deploying the functionality of the EVAC application. While other regions in the U.S. have made significant advancements toward developing and deploying technology to support evacuations, the level of maturity detailed in this report is not currently realized nationally.

Section 2.0 provides an overview of the conceptual functionality for the EVAC application. The material presented in this sectional draws upon the R.E.S.C.U.M.E. Concept of Operations.

Section 3.0 provides an overview of RITIS, which is envisioned to support EVAC application functionality in the NCR.

Section 4.0 provides an overview of CapWIN, which enables a critical information sharing function in support of evacuations in the NCR.

Section 5.0 provides an overview of the existing institutional structures that are in place to support the EVAC functions of the Information Broker.

Section 6.0 provides an analysis of the capability of RITIS and CapWIN to support EVAC as defined in the high-level functional requirements that were defined for R.E.S.C.U.M.E.

Section 7.0 provides an overview of minimal functional requirements that would need to be accommodated to enable the EVAC application in regions other than the National Capital Region. It also provides an examination of how RITIS and CapWIN could be implemented in other regions.

Section 8.0 identifies institutional issues that must considered in the implementation of the Information Broker and EVAC application.

Section 9 provides an overview of other Federal initiatives relevant to the Information Broker and EVAC application.

Chapter 2 Conceptual R.E.S.C.U.M.E. Evacuation Functions

The technologies and systems needed to support evacuation operations can often be fairly "stove-piped" in nature and require significant manual coordination, manipulation, and often duplicate information entries for cross-platform or cross-system utilization. Funding constraints have resulted in jurisdictions building systems that support evacuations in parts over time, and not necessarily with a focus on regional interoperability. In particular, there is a noticeable lack of a single, interoperable, integrated system that can be readily adopted by jurisdictions or that provides two-way communications with evacuees (especially functional needs populations), real-time data on the progress of an evacuation, and dynamic traffic and route guidance. This communication is critical for both evacuees, as well as the first responders and transportation service providers, all of whom play a critical role in supporting evacuation operations.

It is also important to note that, with respect to evacuating those with functional needs, the challenges stem, in part, from the fact that 80 different federal programs fund a variety of transportation services for transportation-disadvantaged populations.[4] Thirty-one of these programs are administered by Health and Human Services (HHS) alone.[5] Further, funding limitations and a general lack of working relationships has also limited coordination among disparate stakeholders.

However, the US DOT does understand that there is a growing need to enhance the efficiency and safety of evacuations. A U.S. Nuclear Regulatory Commission (NRC) study concluded that nationally, evacuations of 1,000 or more people occur approximately every two to three weeks.[6] A broad range of man-made and natural events cause the need for evacuations. The basic nature of these events, their predictability, frequency, geographic scope, intensity, and other factors define the decisions that must be made by public agencies in both pre-event planning and operational response.

At the heart of the R.E.S.C.U.M.E. application bundle is the Information Broker. As envisioned in the R.E.S.C.U.M.E. bundle of applications, the Information Broker requires and incorporates the functionalities currently provided by entities such as emergency operations centers (EOCs) and transportation management centers (TMCs). In addition, as it relates to the functions of EVAC, the

[4] Functional Needs Support Services are services that enable individuals with access and functional needs to maintain their independence in a general population shelter. Individuals requiring FNSS may have physical, sensory, mental health, and cognitive and/or intellectual disabilities affecting their ability to function independently without assistance. Others who may benefit from FNSS include women in the late stages of pregnancy, seniors, and people whose body mass requires special equipment. http://www.phe.gov/Preparedness/planning/abc/Pages/funcitonal-needs.aspx Accessed 5 September 2014.

[5] United States Government Accountability Office. *Transportation-Disadvantaged Populations: Federal Coordination Efforts Could* be *Further Strengthened*. Report to the Committee on Banking, Housing, and Urban Affairs, U.S. Senate. GAO-12-647. June 2012.

[6] *Using Highways for No-Notice Evacuations: Routes to Effective Evacuation Planning Primer Series*. United States Department of Transportation – Federal Highway Administration – Office of Operations. November 2007.

Information Broker entails the functions of a range of commercial entities that provide consumer services (e.g., food, fuel and lodging) and social services providers.

The EVAC applications address the differing information needs of individuals who are able to evacuate themselves, those requiring a certain level of assistance to facilitate a safe and efficient evacuation, as well as the emergency responders who must coordinate evacuation efforts. For those able to use their own means of transportation, this application focuses on providing evacuees with a range of enroute information to assist in helping them evacuate as safely and efficiently as possible. For those who need assistance, this application focuses on integrating information from existing databases to identify and locate people who are more likely to require guidance and evacuation assistance.

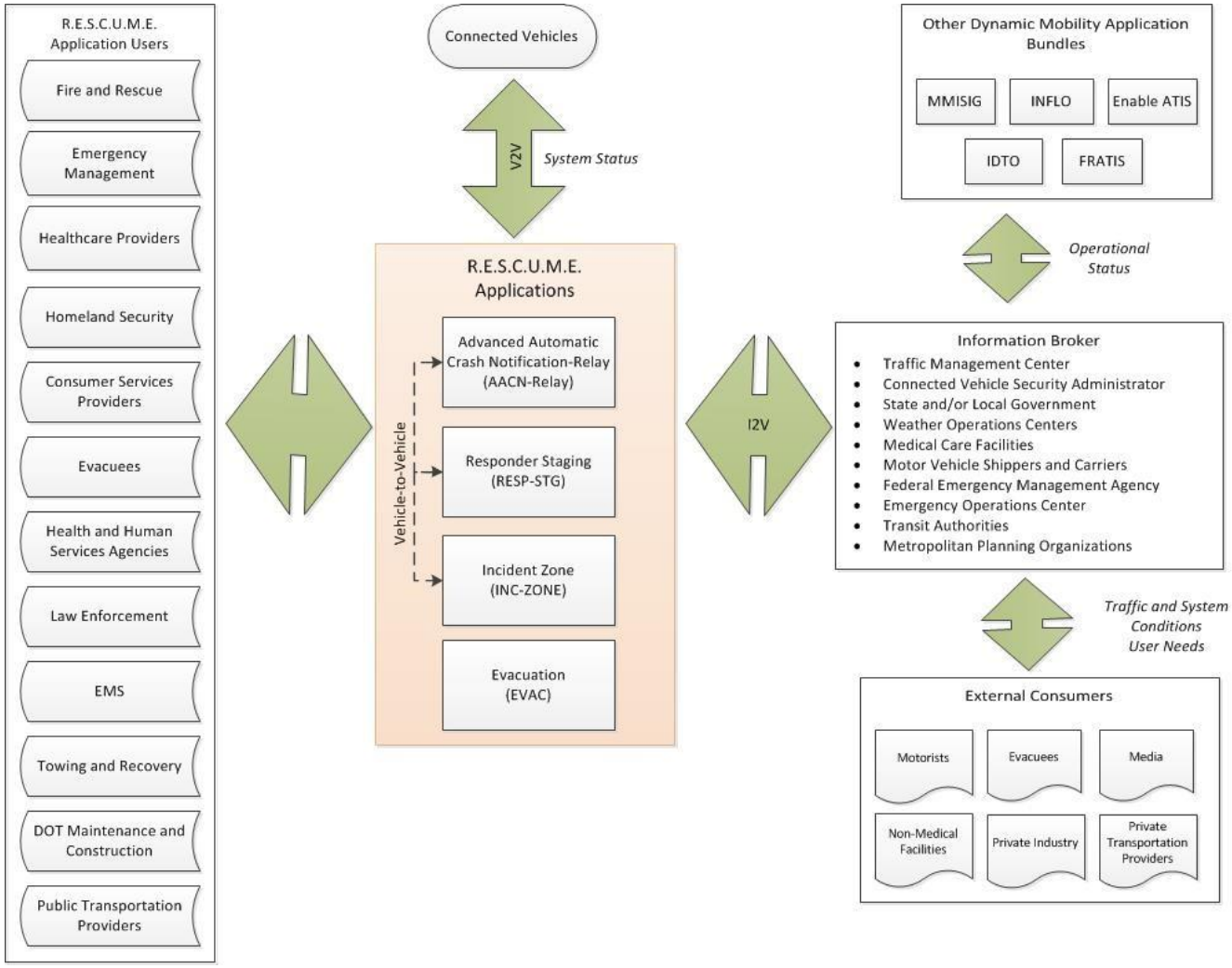
A critical function of the Information Broker and the EVAC components is the efficient and accurate processing of information from the various entities to ensure that messages are consistent, and that the information provided by one entity does not conflict with the information provided by another entity. Functions of both the Information Broker and EVAC application are detailed below.

Figure 2-1 illustrates the overall system concept for the R.E.S.C.U.M.E. Bundle and includes linkages to other key entities including R.E.S.C.U.M.E. Bundle End Users; the remaining envisioned DMA bundles, and external information consumers. Figure 2-2 summarizes the functional components of the EVAC application.

Information Broker

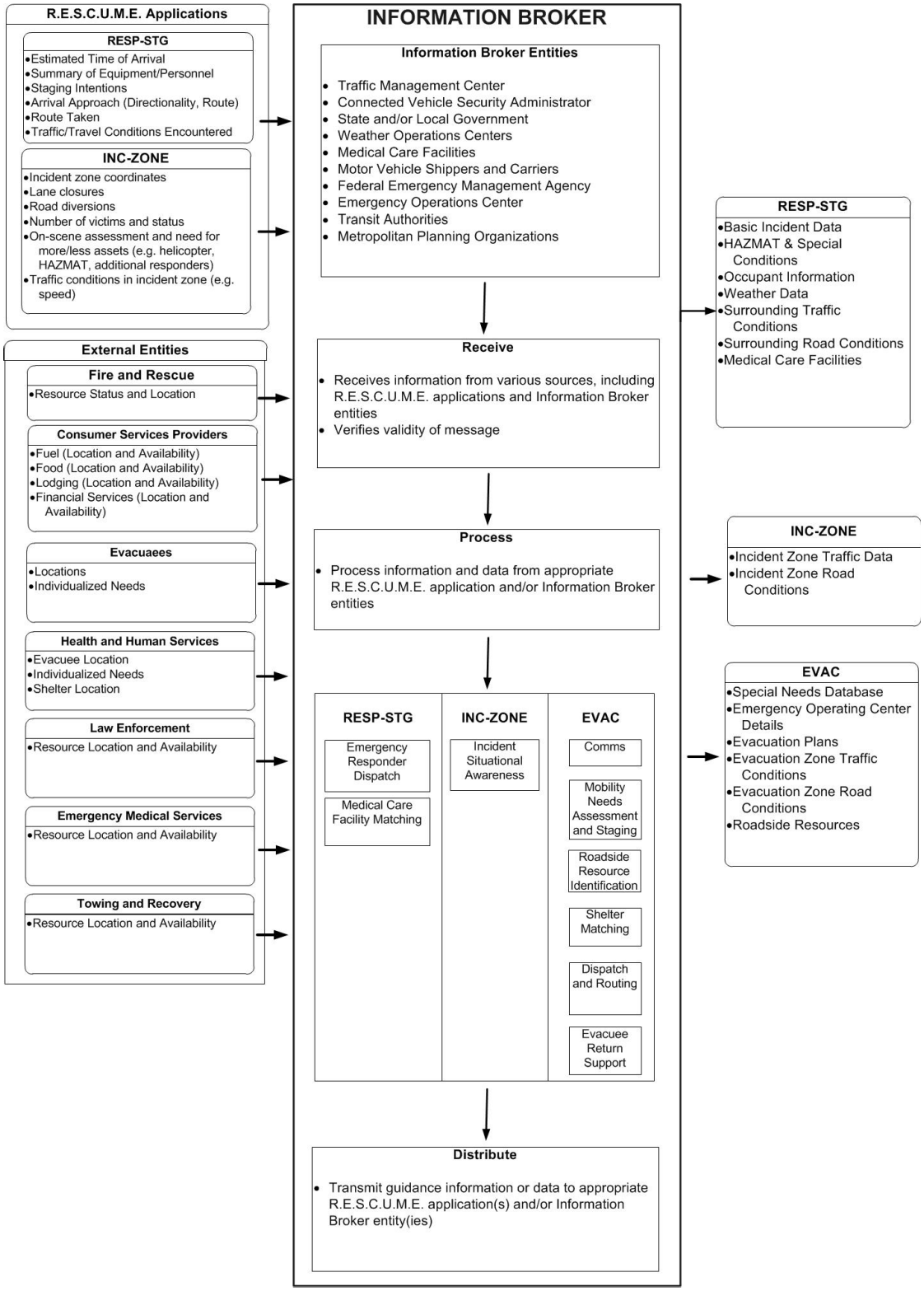
R.E.S.C.U.M.E. applications are being developed with the understanding that they provide "value-added services" to existing systems that assist responders in the performance of their functions while improving the overall mobility of both the responders and the general traveling public during an incident, in addition to supporting evacuations.

The functions of the Information Broker include processing of the received information, determining the entities that need to be informed, and providing other decisions on routing of information and data based upon the breadth of the information available throughout the evacuation. This is not meant to imply that the Information Broker would replace the Incident Commander or subsume the decision-making responsibilities of other organizations. Rather, the Information Broker provides information and facilitates the routing and transfer of information among both internal and external entities. A key functionality of the Information Broker is the ability to rapidly sift through the multitudes of input data; interpret, de-conflict, and correlate the data; and through implementation of algorithms and procedures, make decisions on the relevance of data to a particular incident or evacuation and communicate this information to the appropriate entity. Figure 2-2 illustrates the envisioned framework and various functions of the Information Broker as they relate to evacuation, and the operational relationships among the bundle of R.E.S.C.U.M.E. applications.



Source: Battelle

Figure 2-1. System Overview



Source: Battelle

Figure 2-2. Information Broker Functional Architecture

Emergency Communications for Evacuation

Evacuation of a metropolitan area, or some subset of a metropolitan area, is a challenging endeavor for both those being evacuated and those charged with being responsible for the safety and efficiency of the evacuation. Given their variable nature, evacuations may involve a large region with days of advance notice, such as with an approaching hurricane; or it may be rapid and local such as during a HAZMAT spill.

Evacuation involves coordination of many agencies and functions including emergency management, public safety responders, public and private transportation service providers, and DOTs. Evacuations not only involve the people who have the means and capabilities to evacuate themselves, but also the functional needs population. The planning and execution of an evacuation must consider all categories of functional needs. The purpose of the EVAC application is to facilitate coordination for evacuees in both categories and those who support them in order to execute an evacuation that is as safe and efficient as possible. The EVAC application supports the needs of three general groups of people: those able to evacuate themselves, those in need of assistance, and those supporting the evacuation, which includes a range of public safety personnel and transportation service providers.

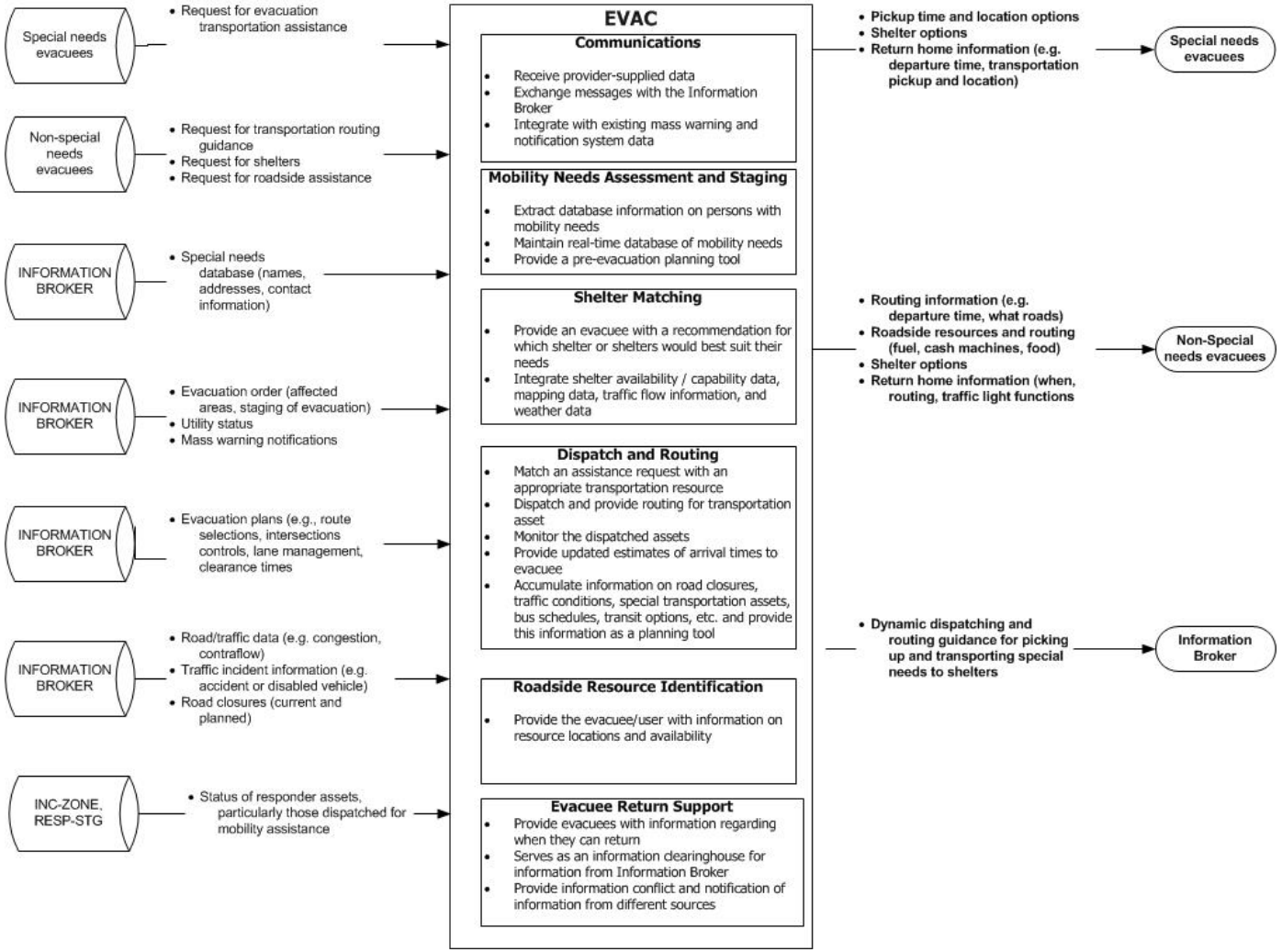
During an evacuation the EVAC application has the ability to push information such as evacuation orders by evacuation zone to registered users of the system (either those that have pre-registered, or real-time registration during the event) through the EVAC application. The TMC working with the EOC will use the EVAC application to coordinate the listing of available transportation resources to assist with functional needs evacuation. The EVAC application can be used to support the dispatch and route the transportation resources to the appropriate location, while providing communications update to those functional needs individuals in need of assistance.

For travelers able to evacuate themselves, the EVAC application provides route guidance that accounts for road conditions, traffic conditions, and final destination. If the evacuee intends to go to a shelter or hotel, the EVAC application provides a shelter matching function to help the evacuee determine where he or she should go based upon shelter availability and capability (e.g., does the shelter accept pets?). Should the evacuee need a resource such as food, fuel or financial services during the evacuation, the EVAC application provides recommended services and is guided by user input to provide information on the availability of the needed resource.

Additionally, the EVAC application provides a Return of Evacuees Function to provide evacuees with information regarding when they can return to their area of the jurisdiction and provide recommended routes, taking into consideration road conditions (i.e., roadway infrastructure and traffic lights). These functions help to reduce the amount of time it takes to evacuate a jurisdiction, promote the use of all available evacuation routes to help minimize traffic congestion, and mitigate secondary incidents such as a car running out of fuel along an evacuation route, or too many people showing up at a shelter that is full and staying on the roads longer (adding to the congestion).

The EVAC application contains multiple functions to support the efficient evacuation of functional needs and non-functional needs evacuees within a jurisdiction as well as provide real-time communications of evacuation instructions and routing guidance that accounts for current road and traffic conditions. These functions are accomplished through the integration and use of existing technologies to include communications functions (i.e., mass warning and notification systems), functional needs pre-registration databases, geographic information systems (GIS), global positioning systems (GPS), computer-aided dispatch (CAD), automatic vehicle location (AVL), traffic information, and weather data. For the users of the application, the majority of the application functions will be accessed through a website and/or a Smartphone application or family of applications. Therefore,

usage of these functions will be predicated on having a Smartphone, having connectivity (through WiFi or service provider), and having the awareness through jurisdiction outreach to know that this application is available and its value to the evacuee. Figure 2-3 illustrates the EVAC application functional architecture.



Source: Battelle

Figure 2-3. EVAC Application Functional Architecture

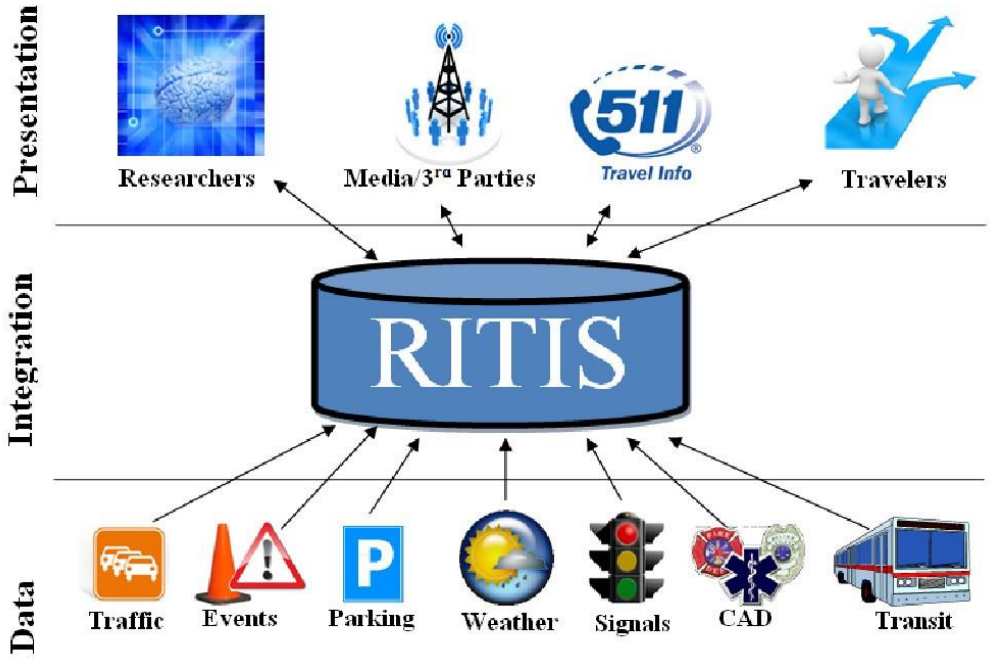
Chapter 3 Regional Integrated Transportation Information System

The NCR is home to some 5.9 million residents. Evacuating the NCR, or some subset of it is a massive and logistically complex undertaking. RITIS has been developed to help support the safe and efficient evacuation of the NCR, among other functions. RITIS is an automated data sharing, dissemination, and archiving system that includes many performance measure, dashboard, and visual analytics tools that help agencies to gain situational awareness, measure performance, and communicate information between agencies and to the public via the website trafficview.org. As noted previously, RITIS is unique to the NCR and its discussion only serves as an example of how the EVAC applications can be developed and supported. Other regions throughout the U.S. will vary in terms of approach and technological maturity.

RITIS automatically fuses and standardizes data obtained from multiple agencies in order to provide an enhanced overall view of the transportation network. Participating agencies are able to view transportation and related emergency 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. Although RITIS does not currently support the entirety of the functions envisioned for the EVAC application, it does contains three primary functional components that do support evacuation operations:

- Real-time data feeds,
- Real-time situational awareness tools, and
- Tools for analysis of archived data.

Figure 3-1 illustrates a high-level functional overview of RITIS.



Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-1. RITIS Functional Overview

Functional Components

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 ITS device status, such as messages being displayed on a DMS. The RITIS data feeds are designed to facilitate integration of RITIS data back into legacy and third party systems and for 3rd party application developers that need access to real-time information for dynamic mobility applications. The data feeds provide for implementation flexibility both in data format and retrieval method. RITIS allows user agencies in the NCR (and elsewhere) to determine which data elements they wish to provide in the data feed or to maintain secure and secluded from other agencies or the public. These data feeds are critical to transportation service providers in making operational decisions throughout the course of an evacuation.

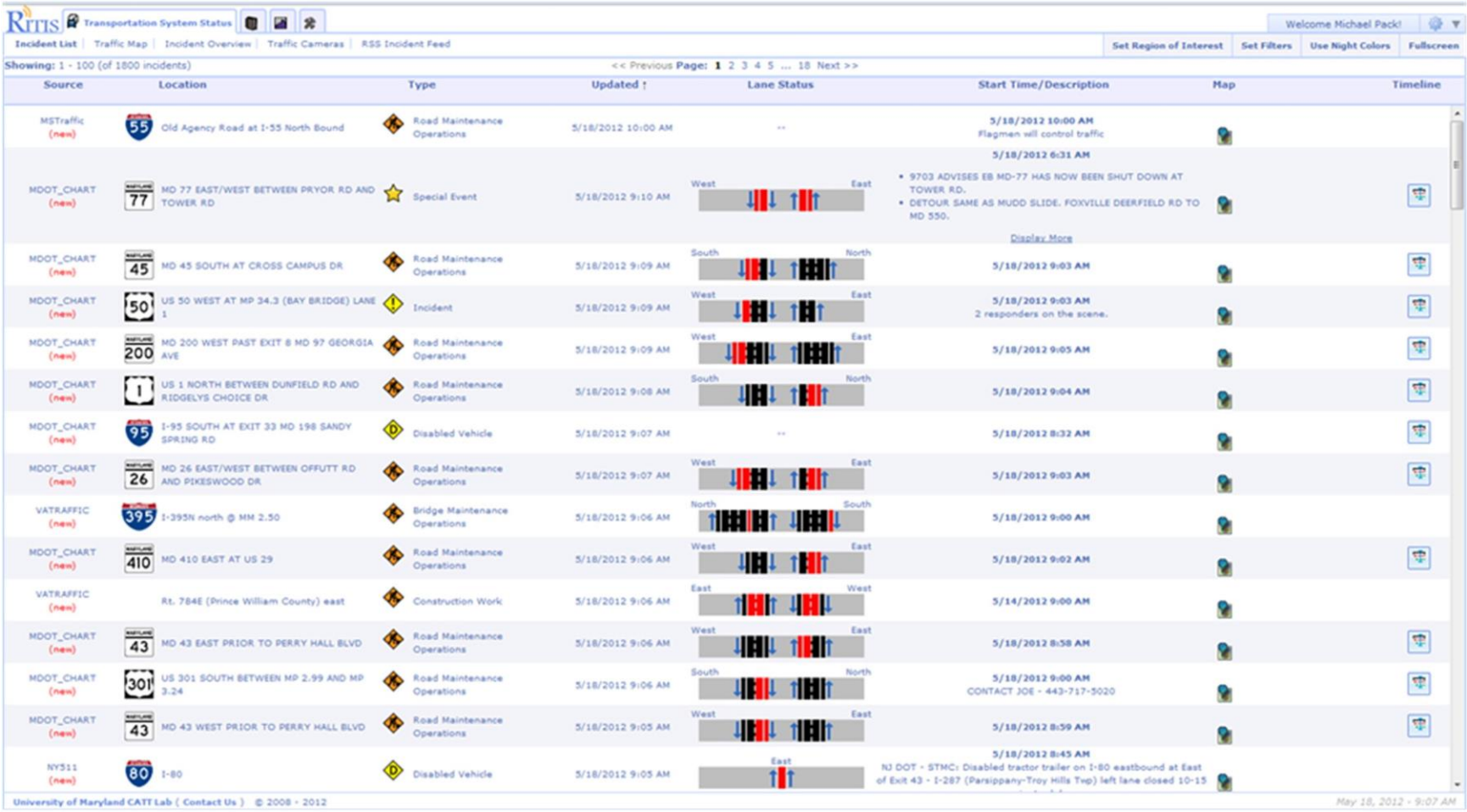
Real-Time Situational Awareness Tools

The RITIS website enables transportation service providers and public safety agencies with appropriate credentials to access real-time RITIS data in a browser. The website provides users with a range of tools that are useful in the execution of a safe and efficient evacuation. Authorized users can interact with live events, incidents, weather, sensors, radio scanners, and other data sources and devices in maps, lists, and other graphic formats. Users can apply a rich set of filters, access contact information, and even set up alerts. It is important to note that direct database access to RITIS is provided free-of-charge to government agencies. However, direct access to some data components are not provided to the general public or private sector organizations due to the sensitive nature of the

data that is provided and used by partner agencies. Figure 3-2 shows one RITIS interface that provides for the exchange of a range of data elements, including video feeds, traffic and weather conditions, and incidents. Figure 3-3 shows an incident log which is available to RITIS users, and can be an important resource when managing a regional evacuation.

Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-2. RITIS Map Showing Video, Weather, Traffic and Incident Information

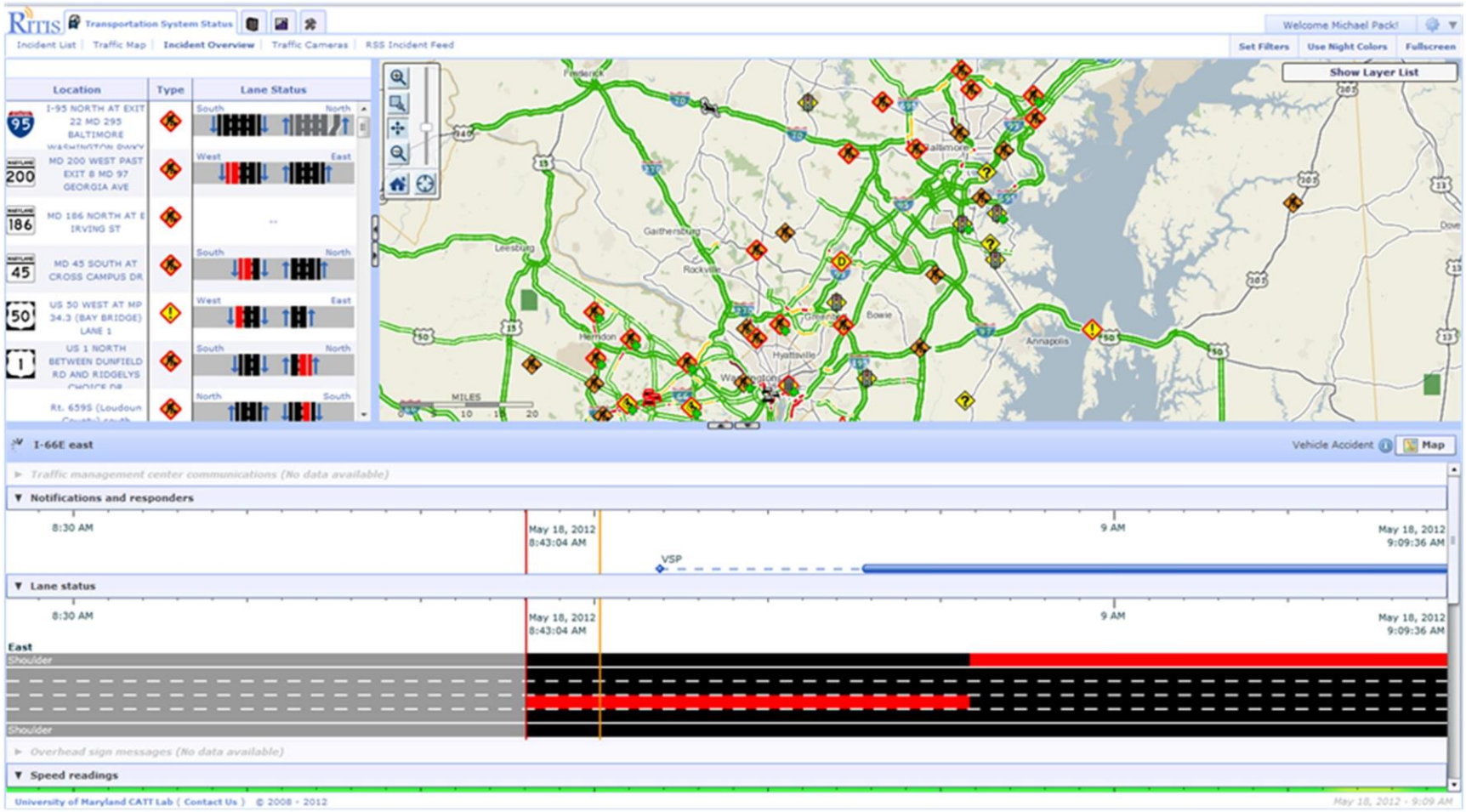


Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-3. RITIS Incident Log

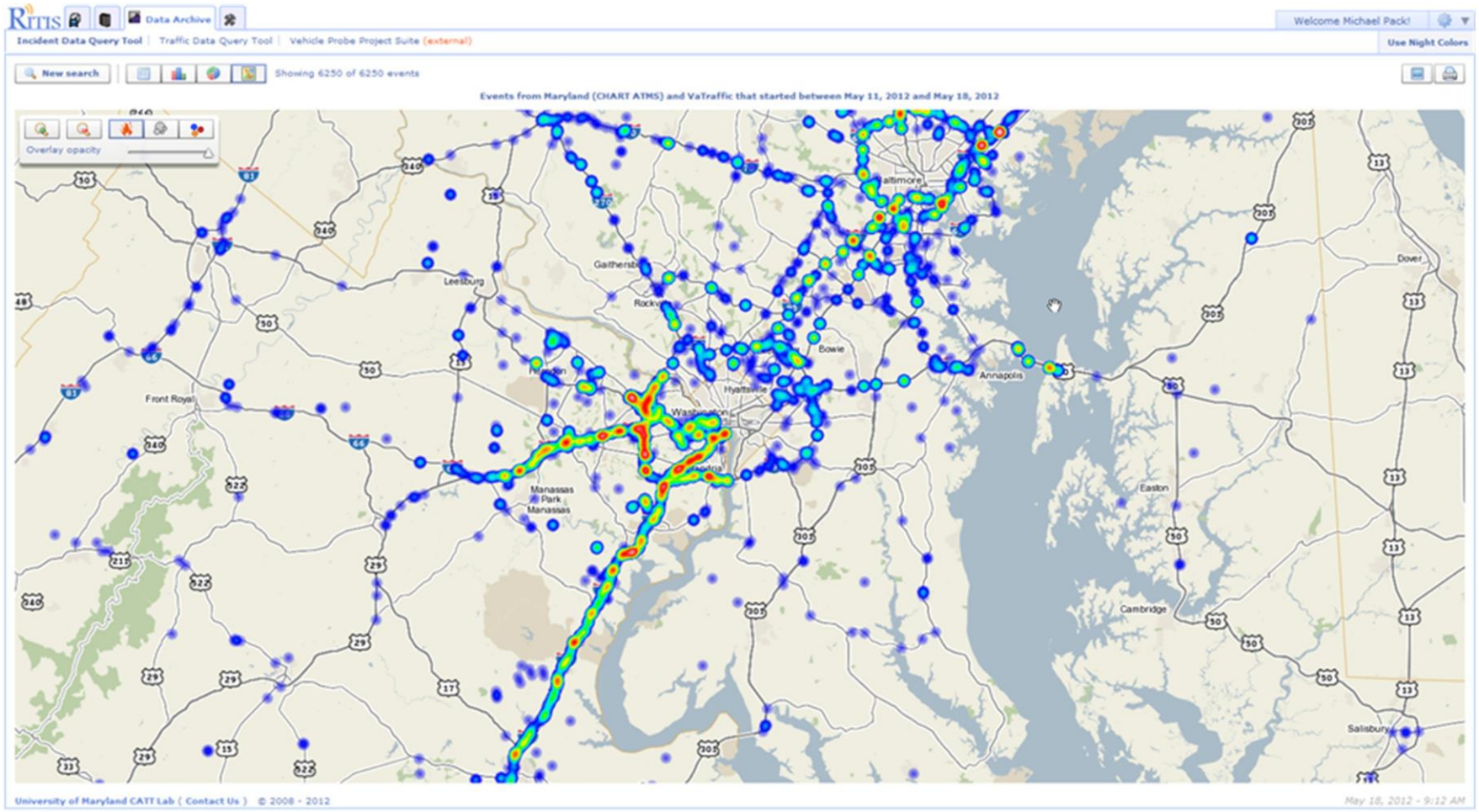
Archived Data Analysis Tools

All data within RITIS is archived indefinitely and made available to support a range of functions for registered users, including planning and simulation modeling for executing regional evacuations. The Archived Data Analysis Tools allow data to be queried and analyzed to derive performance measures, including those which can be applied to evacuation operations. The Archived Data Analysis Tools can be used to analyze a range of variables that are relevant to evacuation operations and to support after-actions. Figure 3-4 shows the incident timeline function that is available through RITIS. Figure 3-5 illustrates an "incident heat map" which shows areas where a significant number of incidents occurred, and can be generated through RITIS to support evacuation planning activities. Figure 3-6 shows a chart that can be generated by RITIS users to determine the duration of incidents, which can also be used in planning for evacuations. This figure shows the average duration of incidents as report by VATraffic and Maryland Coordinated Highways Action Response Team (CHART) from May 11-18, 2012. Figure 3-7 illustrates incident query logs that can be generated through RITIS, and correlated to the execution evacuation operations for both evaluation and planning activities. Similar to the "incident heat map," Figure 3-8 shows a map that can also be created to support evacuation planning activities.



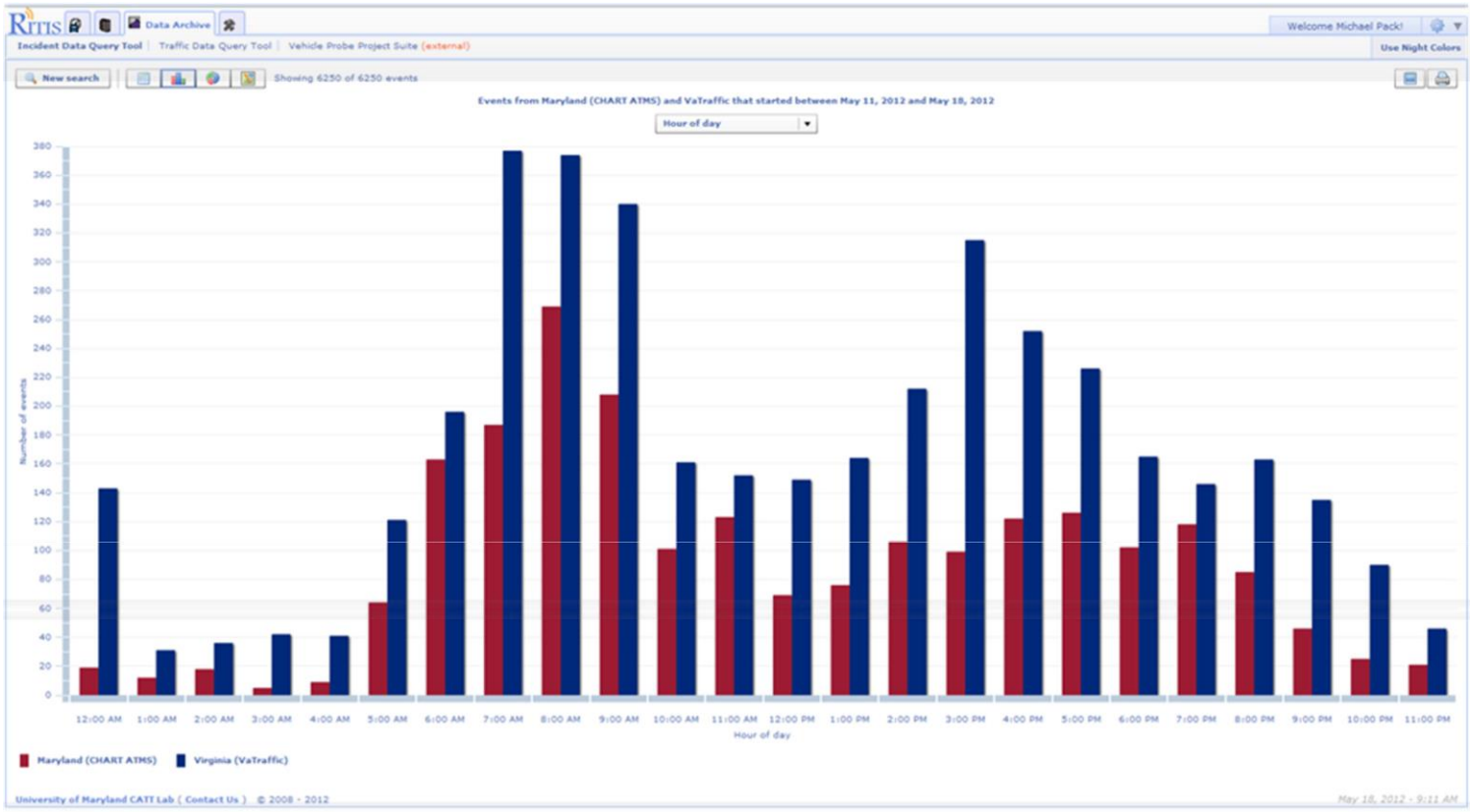
Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-4. RITIS Incident Timeline



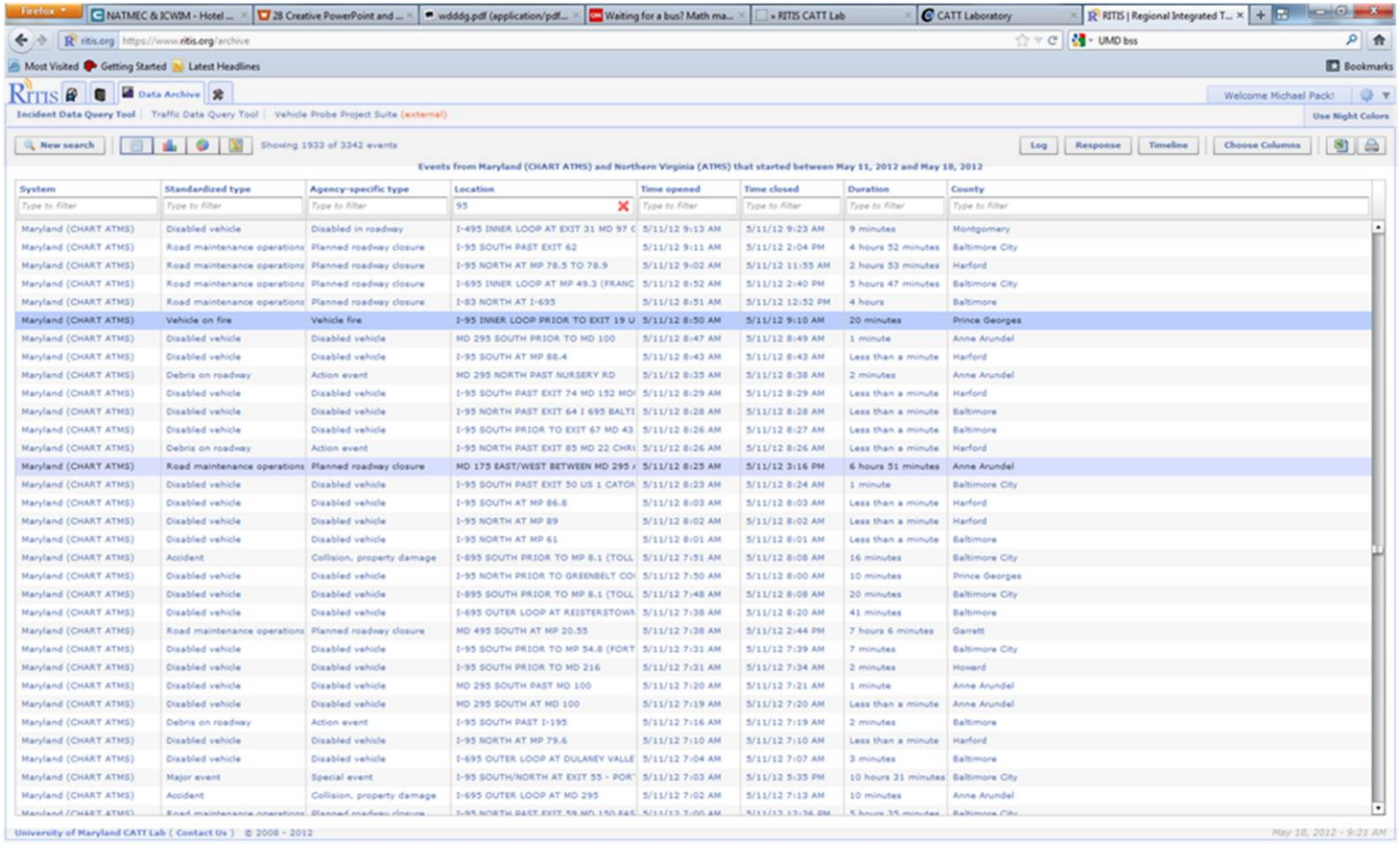
Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-5. RITIS Heatmap of Incident Locations



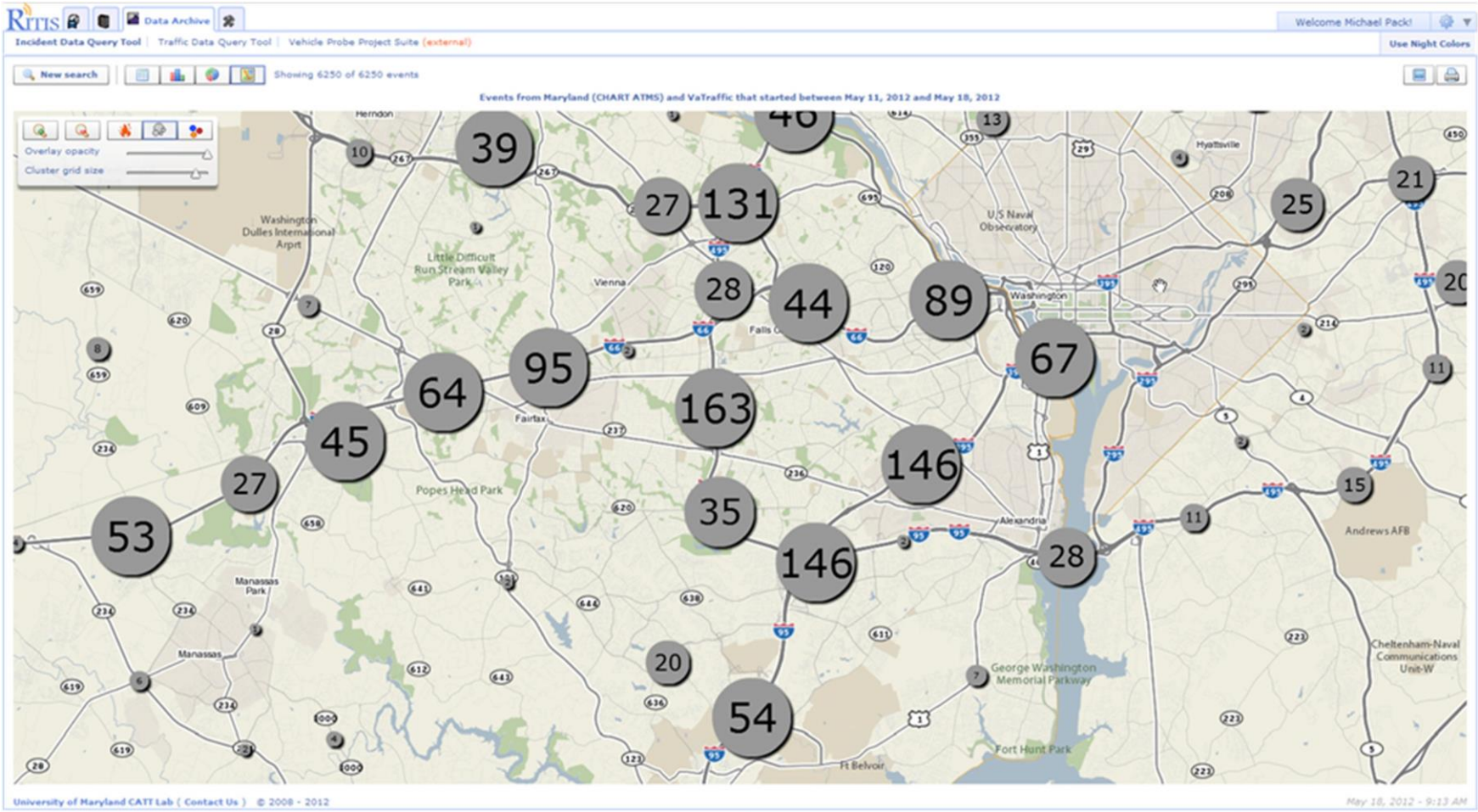
Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-6. RITIS Incident Chart Showing Average Lengths of Incidents



Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-7. RITIS Incident Query



Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-8. RITIS Incident by Specific Location

RITIS Data

As mentioned above, RITIS automatically fuses, translates, and standardizes data obtained from multiple member agencies in Virginia, Maryland and the District of Columbia. This data includes, but is not limited to:

- **Traffic volume and speed data.** Collected by agencies and service providers.
- **Incident information.** Including location, type, severity, vehicles involved, and responders; lane closures; and messages on VMS, as well as similar information on planned lane closures and special events.
- **Weather data.** RITIS collects and distribute weather alerts and radar data from the National Weather Service (NWS), and weather and pavement surface conditions that agencies gather from RWIS stations.
- **Device operational status.** 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.** Status of high-occupancy vehicle (HOV), high-occupancy toll (HOT), and reversible lanes.
- **Video surveillance.** Live closed-circuit television (CCTV) feeds.
- **Transit alerts.** Sent out by regional transit service providers.
- **Service vehicle location.** For automated vehicle locator (AVL)-equipped vehicles, including buses, emergency response vehicles, and freeway service patrols.
- **Signal status.** Operational status of each signal, such as operational, maintenance mode, flashing, or offline.
- **Signal timing data.** Timing plans and real-time information on the current timing scheme where available.
- **Traveler information.** Messages that agencies relay through HAR, as well as alerts that agencies send out to mobile phones, PDAs or other personal and in-vehicle devices.
- **Computer-aided dispatch (CAD) data.** Data from public safety partner CAD systems.
- **Static, descriptive infrastructure data.** Information on roadway infrastructure and transit characteristics. For transit, this includes schedules, routes, and stops. For roadways, includes information such as number of lanes, weight and height restrictions, speed limits, evacuation routes, and location of intelligent transportation system (ITS) devices.[7]

[7] Center for Advanced Transportation Technologies – University of Maryland, Volpe National Transportation Center. *Concept of Operations – Regional Integrated Transportation Information System.* April 2007.

RITIS Architecture

RITIS employs a distributed architecture where duplicate databases are deployed at multiple physical locations. A single translation layer is used to load the data into each of these databases. User 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 is important in that failure of one of the databases does not affect the operation of RITIS since all the other databases are redundant and used for load sharing.[8]

In addition, the RITIS architecture provides a range of operational benefits, including:

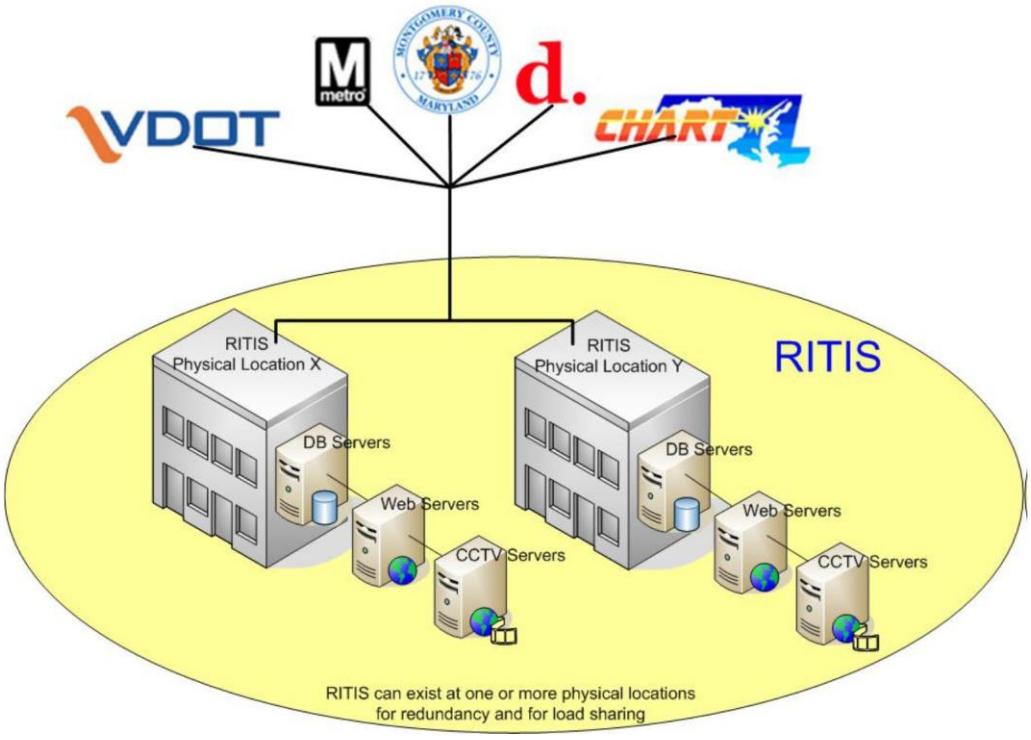
- Distributed transactions run in parallel, increasing processing speed.
- A single mechanism handles data translation and standardization for all providers and consumers, eliminating the need for a unique translation mechanism for each producer/consumer pair.
- Data redundancy improves system reliability.

The RITIS architecture is consistent with the Washington, D.C. area's regional ITS architecture, the Federal Highway Administration (FHWA) Rule on ITS Architecture and Standards Conformity, and the Federal Transit Administration's (FTA) Policy on ITS Architecture and Standards Conformity.[9,10] Figure 3-9 illustrates the RITIS distributed architecture.

[8] Center for Advanced Transportation Technologies – University of Maryland, Volpe National Transportation Center. *Concept of Operations – Regional Integrated Transportation Information System.* April 2007.

[9] http://ops.fhwa.dot.gov/its_arch_imp/policy_1.htm

[10] http://ops.fhwa.dot.gov/its_arch_imp/policy_2.htm



Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-9. RITIS Distributed Architecture

Evacuation Support Capabilities in RITIS

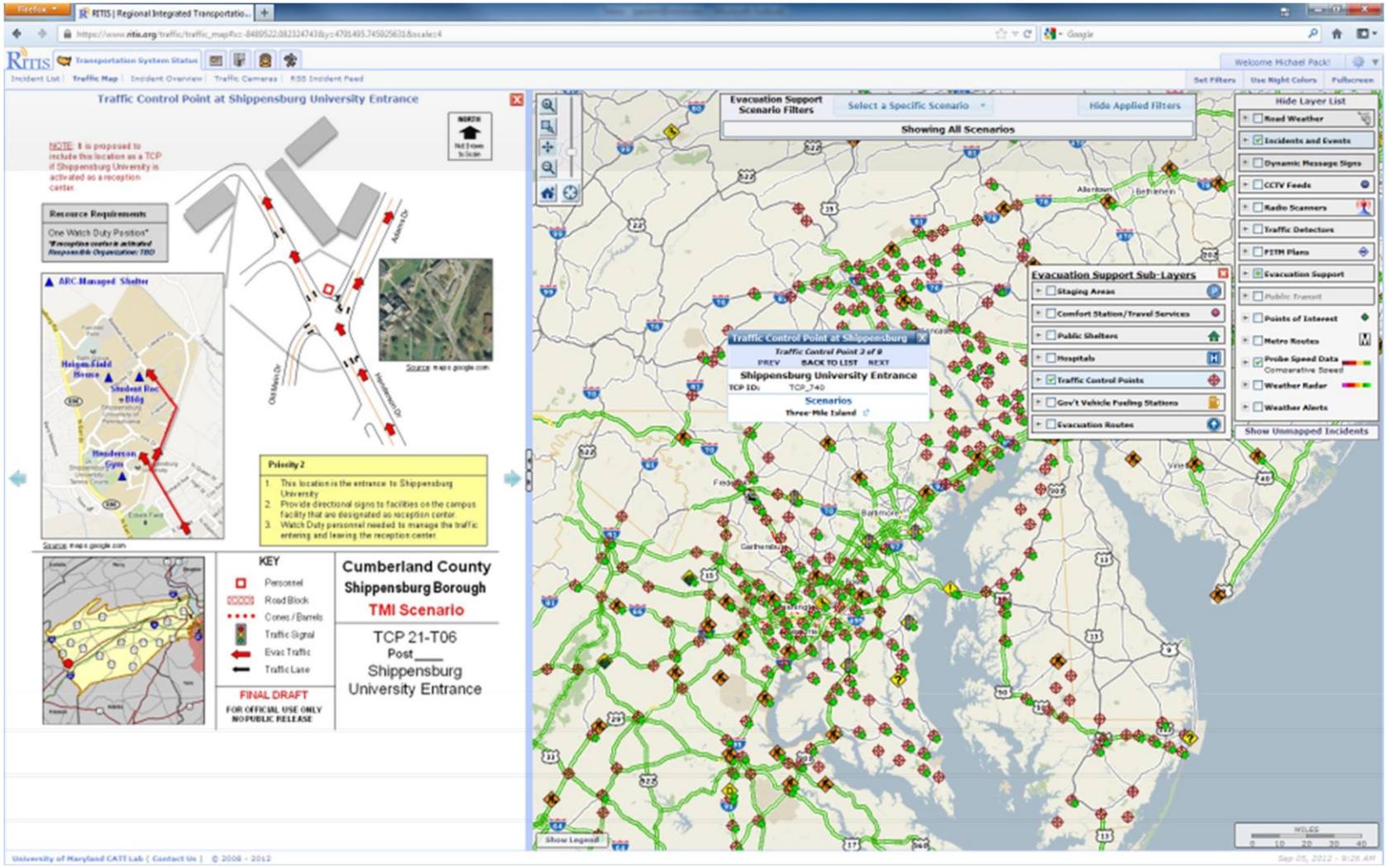
Operational Support

A number of evacuation support sub-layers are currently available within RITIS that together provide a consolidated view of evacuation related information. The information provided through these functions is critical to tools that enable agencies to share information internally, with other agencies, the traveling public, and the media to facilitate safe and efficient evacuations.

Figure 3-10 illustrates the current suite of evacuation support layers that are currently enabled through RITIS and available to partner agencies. Figure 3-11 shows some of the hundreds of pre-planned traffic control points that are provided through RITIS to support evacuation operations. This function is critical in the support of those evacuating themselves. Figure 3-12 shows a map identifying the hospitals in the NCR. Identification of these facilities is critical in that they may be a destination for those with medical problems that are unable to evacuate themselves, as well as for those injured in mass casualty events that necessitate evacuations. Figure 3-13 shows an example of evacuation support staging areas including digital photos showing access point details. This information is useful for responders in the field and those manning operations centers while managing safe and efficient evacuations. Figure 3-14 shows how individual pre-planned evacuation scenarios are included in RITIS. Maryland, for example, includes a number of scenarios, and Figure 3-14 shows how the scenario for the evacuation of Calvert Cliffs is easily accessed through drill-down menus.

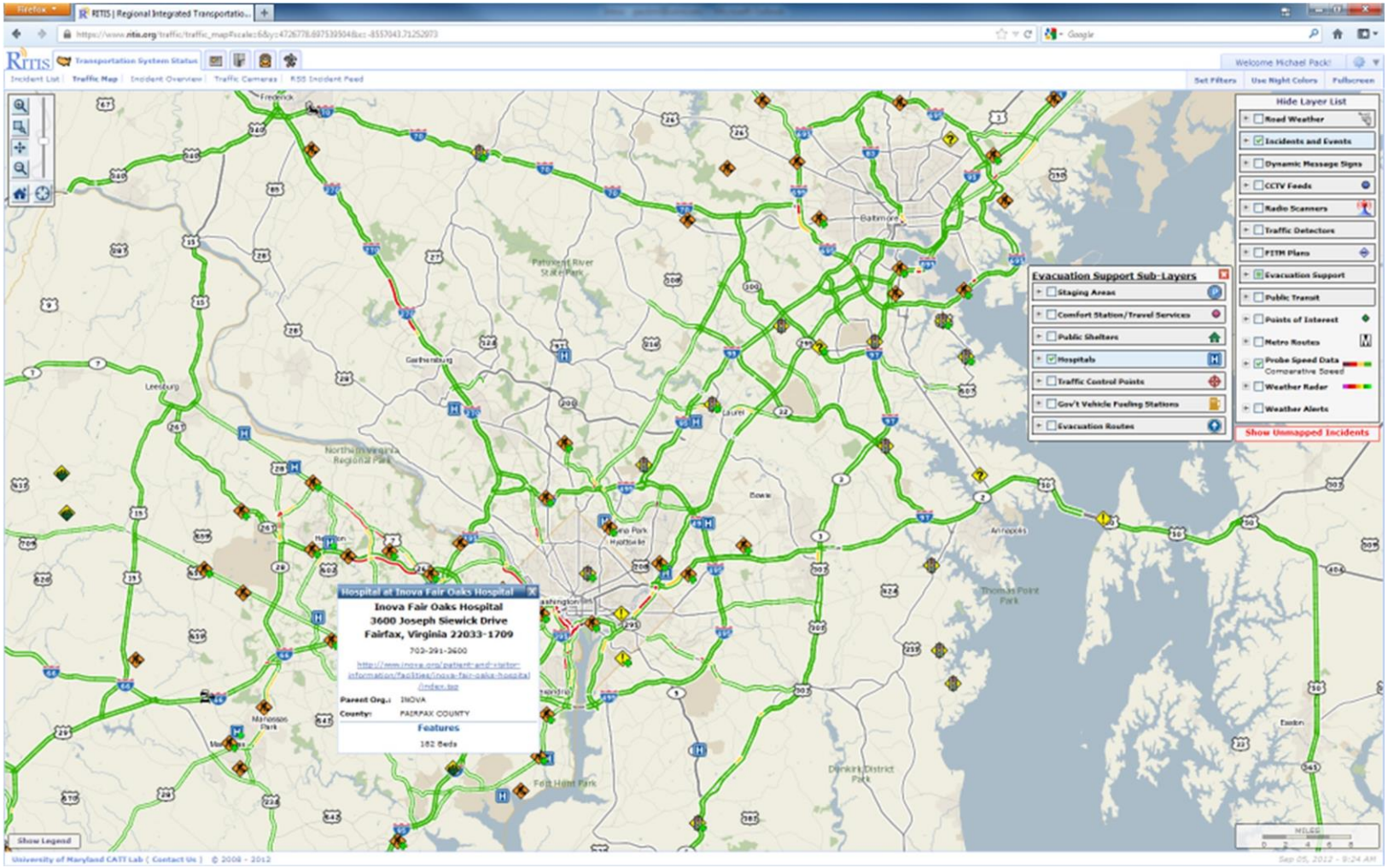
Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-10. RITIS Evacuation Support Layers



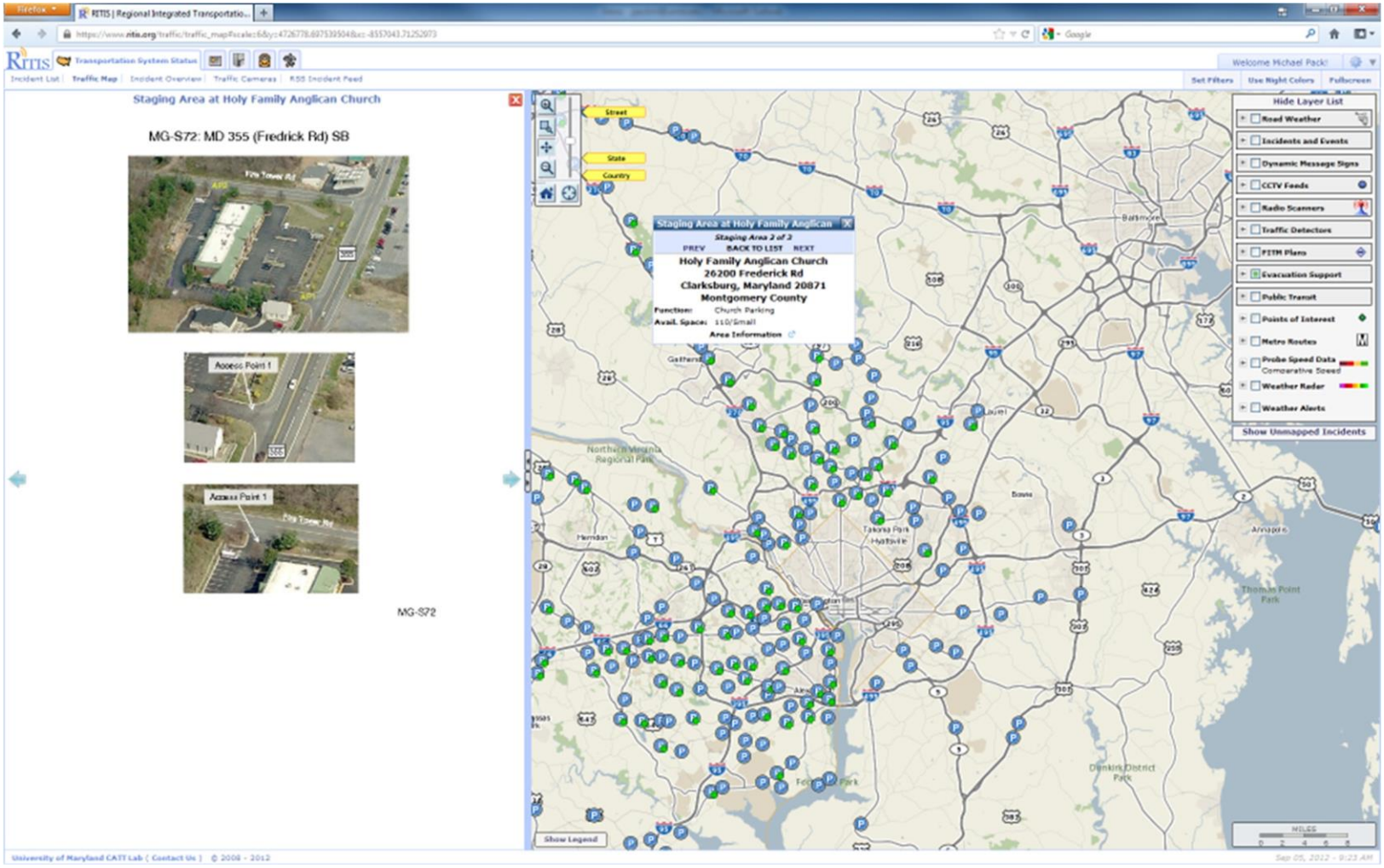
Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-11. RITIS Map of Pre-planned Traffic Control Points



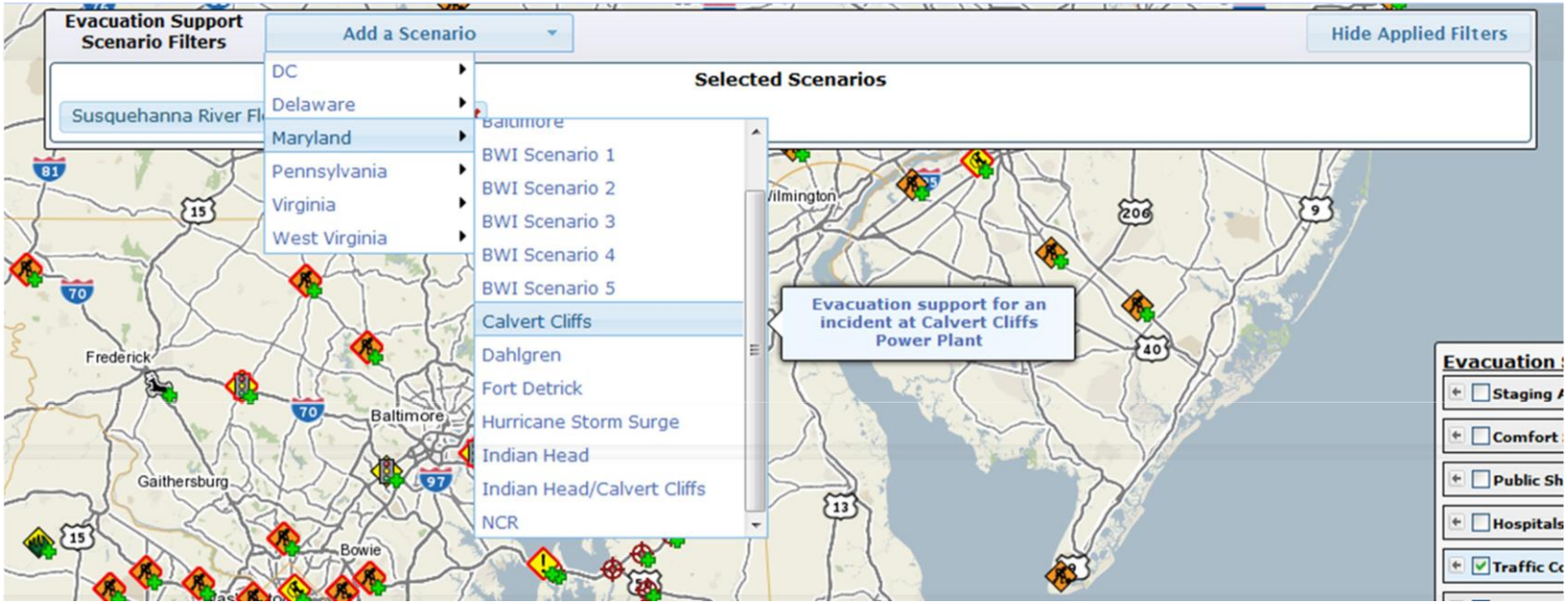
Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-12. RITIS Map of Hospital Locations



Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-13. RITIS Map of Evacuation Staging Areas



Source: University of Maryland – Center for Advanced Transportation Technology

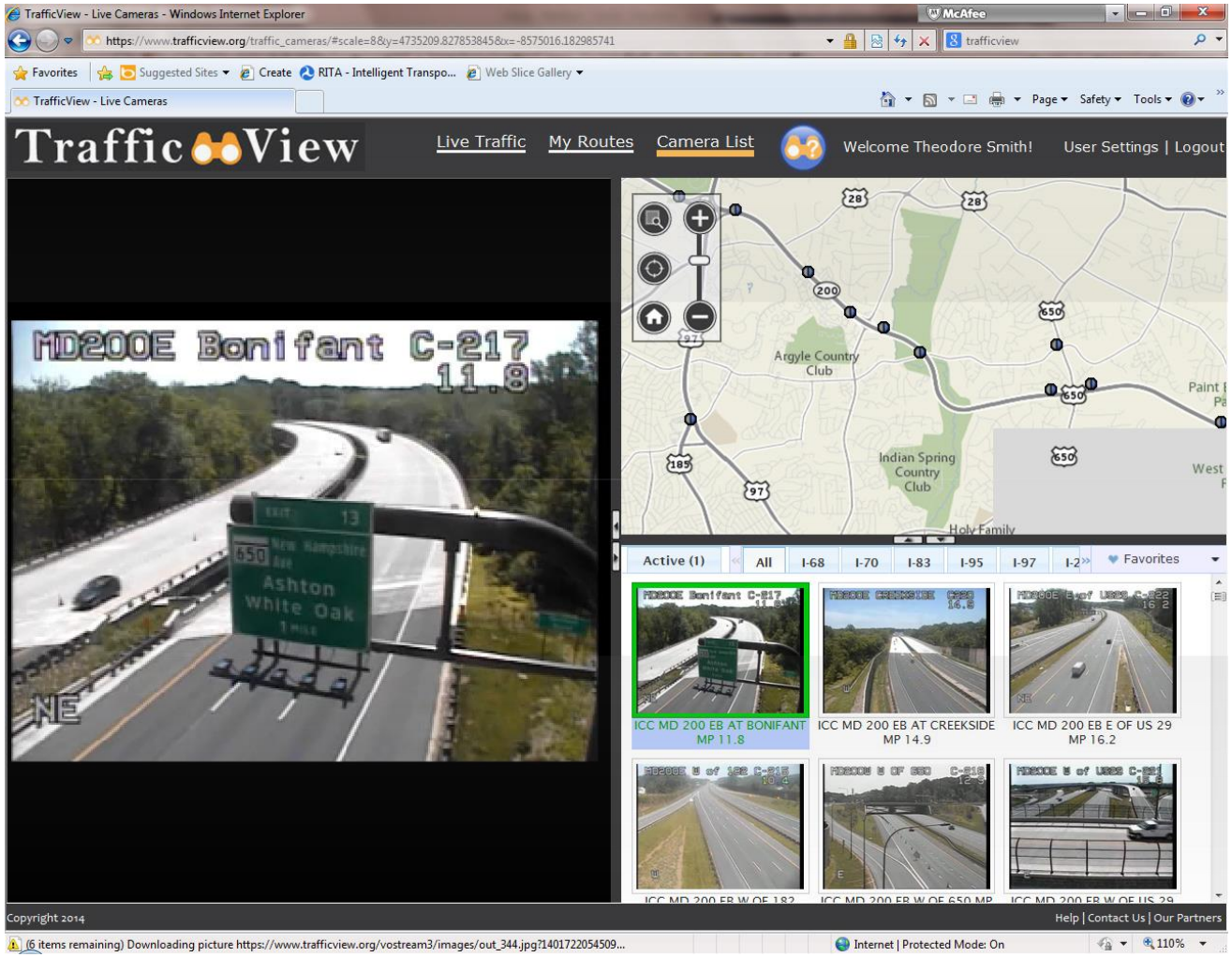
Figure 3-14. Example of RITIS Pre-planned Evacuation Scenario

Traveler Information

RITIS also provides a portal via trafficview.org to the general public that provides travelers with a range of information to assist in making regional travel more efficient during normal operations and during evacuations. Information that is made available to travelers includes:

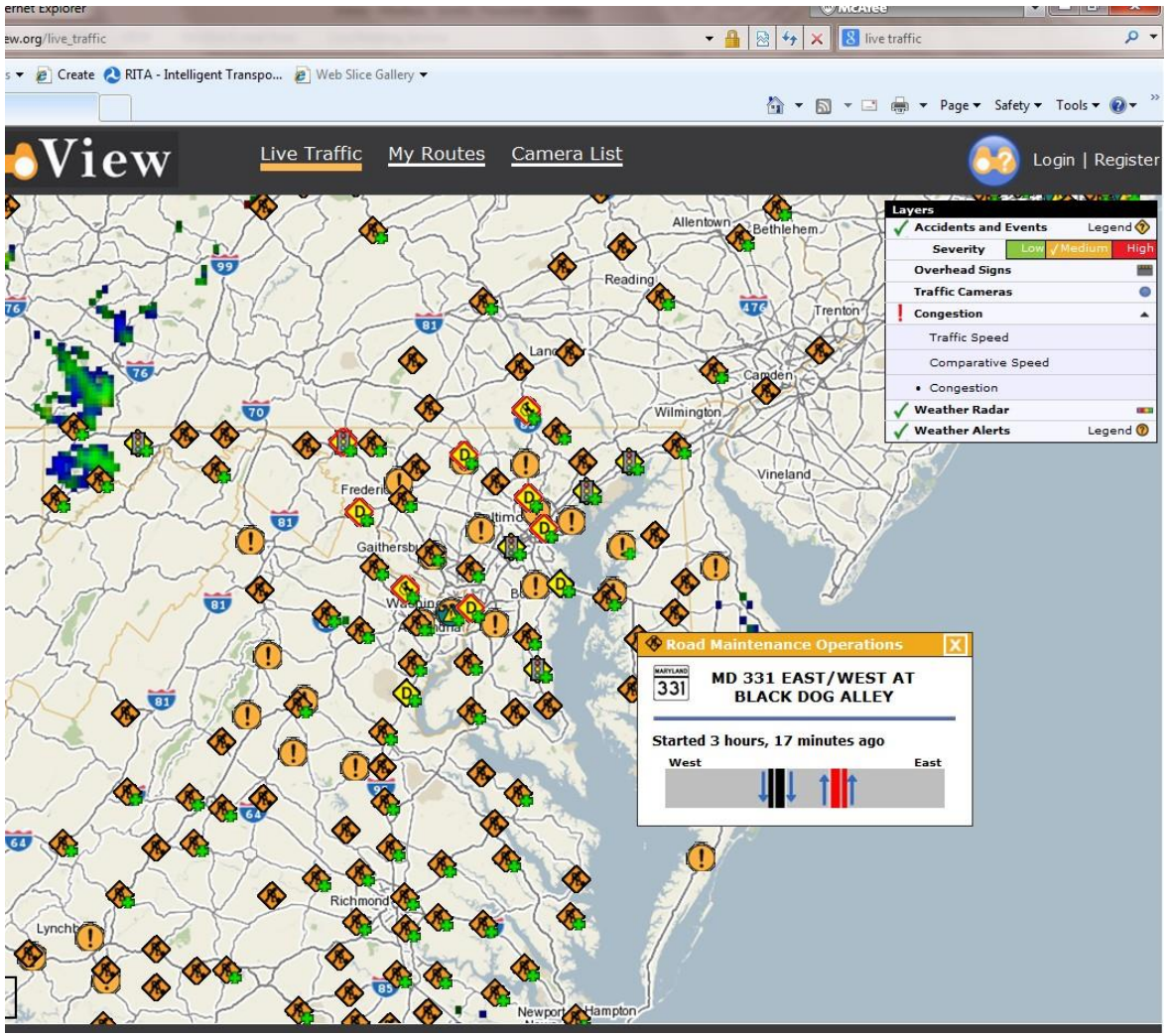
- Video feeds from a regional network of CCTV cameras,
- Status of messages being shown on DMS,
- Weather alerts,
- Weather radar,
- Incident locations and severity,
- Speed data,
- Congestion information,
- Road closures and construction information.

Trafficview.org also enables users to pre-select and save a range of cameras along the user-defined travel routes. Figure 3-15 illustrates this "Camera List" function which could be configured individually to support those evacuating themselves. Figure 3-16 shows the range of traveler information that is available to travelers in graphic format, which can also be useful in the event of an evacuation.



Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-15. TrafficView Camera List User Interface



Source: University of Maryland – Center for Advanced Transportation Technology

Figure 3-16. LiveTraffic Current Conditions User Interface

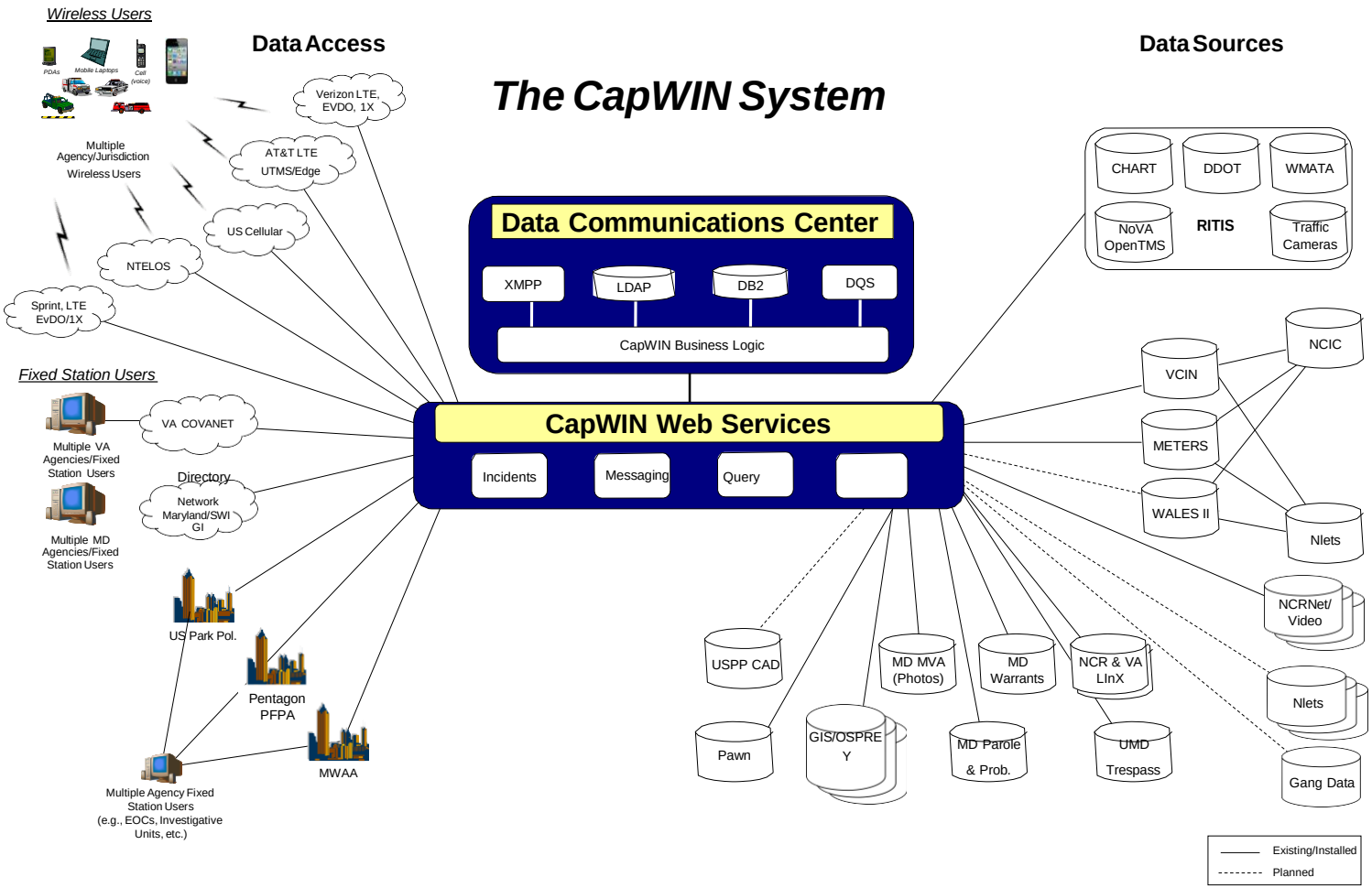
Chapter 4 Capital Wireless Information Net (CapWIN)

CapWIN is a program located in the University of Maryland's Center for Advanced Transportation Technology (CATT) that was created by, and continues to operate under the direction of a coalition of law enforcement, fire/EMS, and transportation agencies in Maryland, Virginia, and the District of Columbia to advance data communications across agency, jurisdiction, government, and discipline boundaries.

To advance its mission, CapWIN has implemented an operating system that delivers data to personnel in the field across disciplines and agency boundaries. It has created a set of software products and services that supports field operations of public safety and transportation agencies. The CapWIN Software Solution Suite is a set of government, off-the-shelf (GOTS) standards-based solutions that gives users access to multiple data sources (e.g., law enforcement systems such as criminal justice information systems (CJIS) in the three states, Maryland driver's license photos, and regional transportation incident data. Two mobile client applications—one for laptops and one for handheld devices—support field access to law enforcement and other data sources, secure instant messaging, and incident coordination tools.

CapWIN's technical infrastructure was designed by a coalition of representatives from public safety and transportation agencies across Maryland, Virginia and the District of Columbia. Based on national data exchange standards, the CapWIN system uses standard web service components that can be easily adapted to evolving mobile communication technologies, and to the requirements for compatibility with legacy agency infrastructures. Figure 4-1 illustrates the functionality of the CapWIN system.

As with RITIS, CapWIN is unique to the NCR and its discussion only serves as an example of how the EVAC applications can be developed and supported. Other regions throughout the U.S. will vary in terms of approach and technological maturity.



Source: University of Maryland – Capital Wireless Information Net

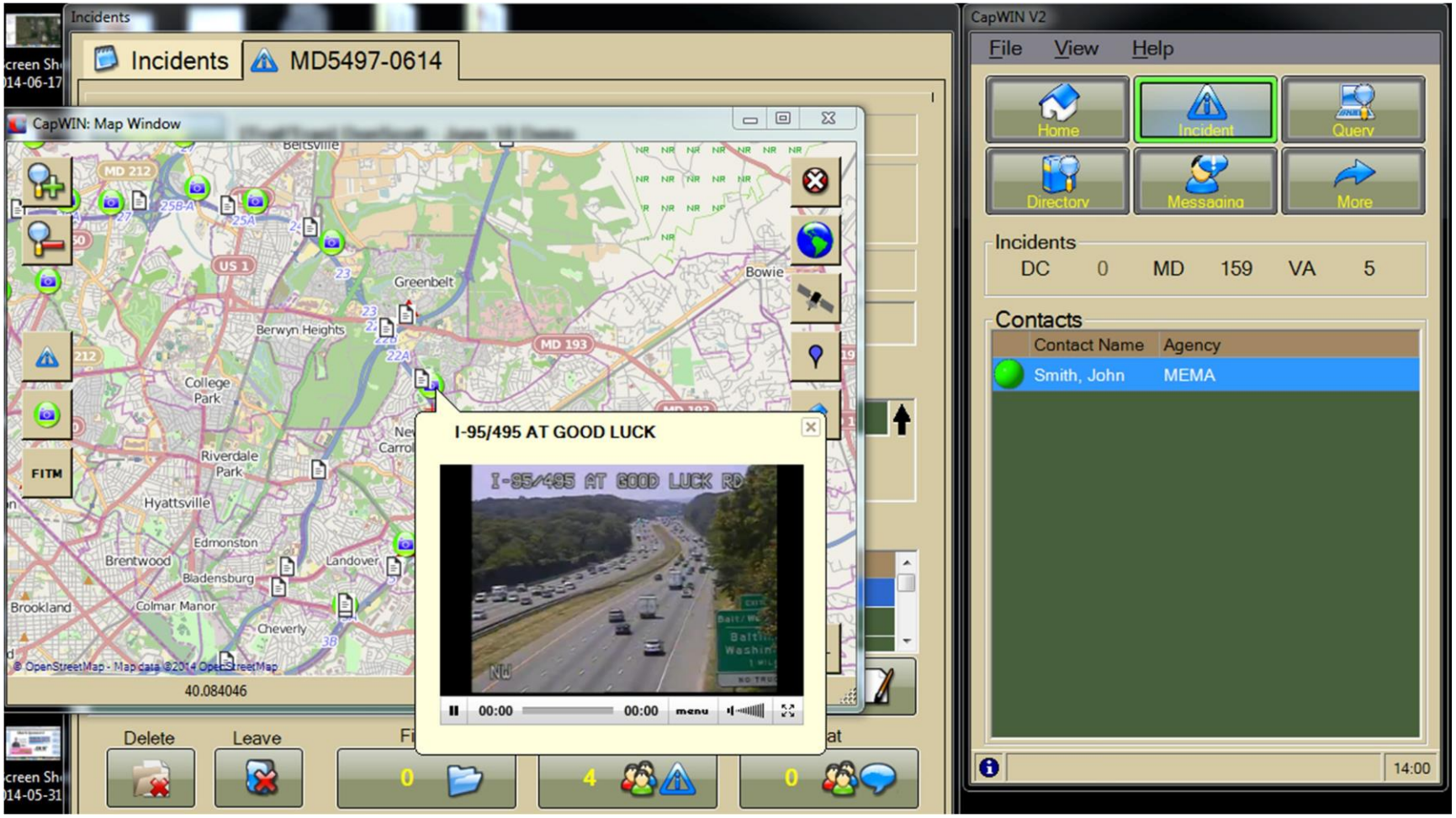
Figure 4-1. CapWIN Functional Overview

CapWIN's Mobile Clients are designed for maximum performance in wireless, field environments. By utilizing a web services-based interface, CapWIN Clients minimize bandwidth needs while maximizing field performance and capabilities. CapWIN Clients incorporate auto-updating capabilities, resulting in "zero touch" upgrades. CapWIN Clients enable:

- Local queuing of law enforcement queries
- Persistent "store and forward" messaging
- Local rendering of GIS maps supporting location-based services
- User-customizable application and network linking

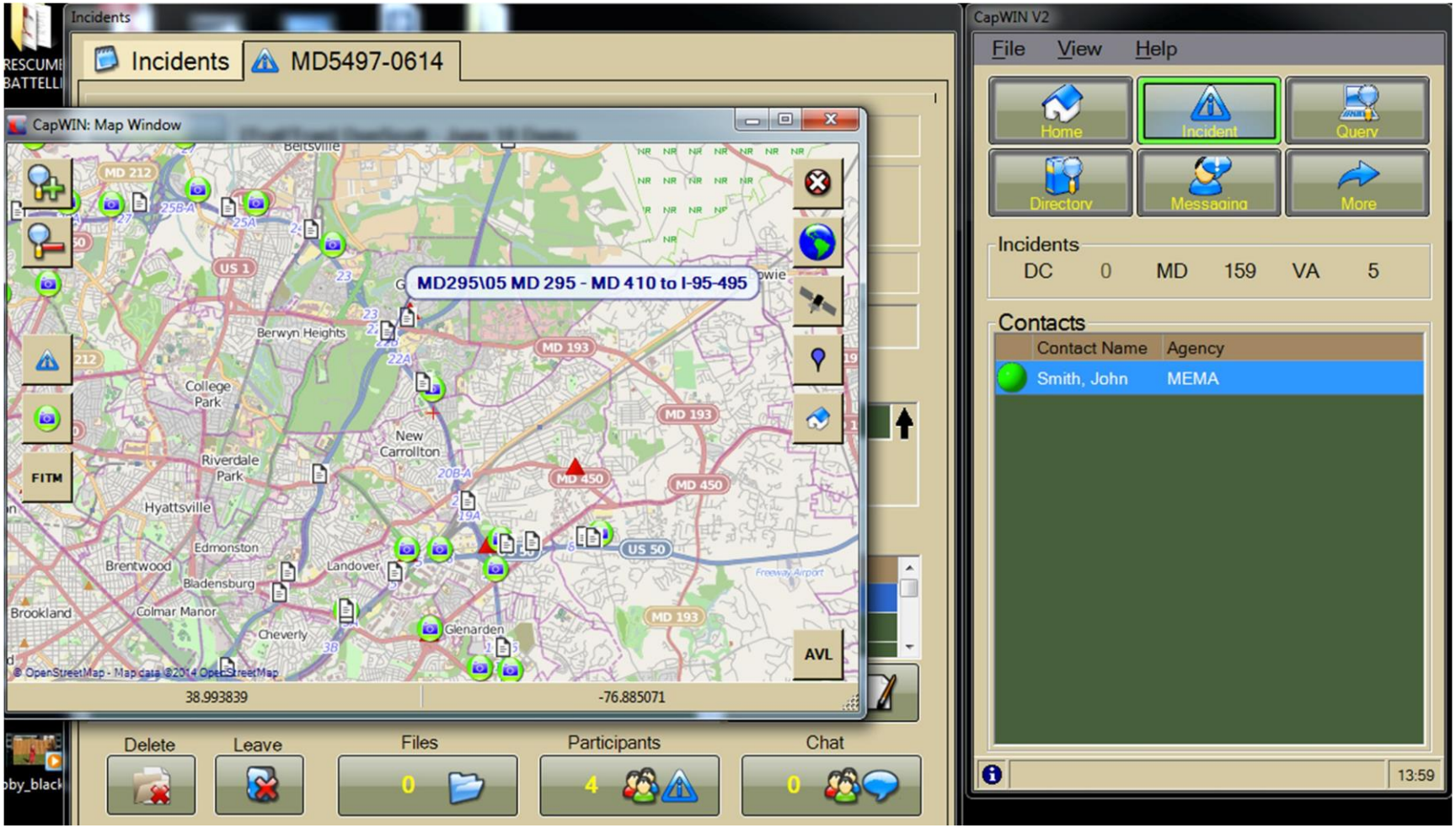
CapWIN's data infrastructure also supports agencies using different mobile clients. For example, several jurisdictions in Maryland use CapWIN Web Services to access and deliver driver's license photos to law enforcement officers in the field through their own mobile data client.

Although CapWIN is a consumer of RITIS data it is important to note that it also provides a platform for giving public safety and transportation agency users the ability to communicate during normal operations, and during emergency situations like evacuations. For example, Figure 4-2 illustrates how video feeds are made available to responders in the field. This data can be useful in making decisions during evacuation operations. Figure 4-3 and Figure 4-4 illustrate the freeway rerouting layer and associated plans that are provided through the CapWIN mobile platform interface as well. These layers are used to identify pre-defined rerouting plans in the event of roadway closures. As with the live video feeds, this information can be useful to responder's support of evacuation operations.



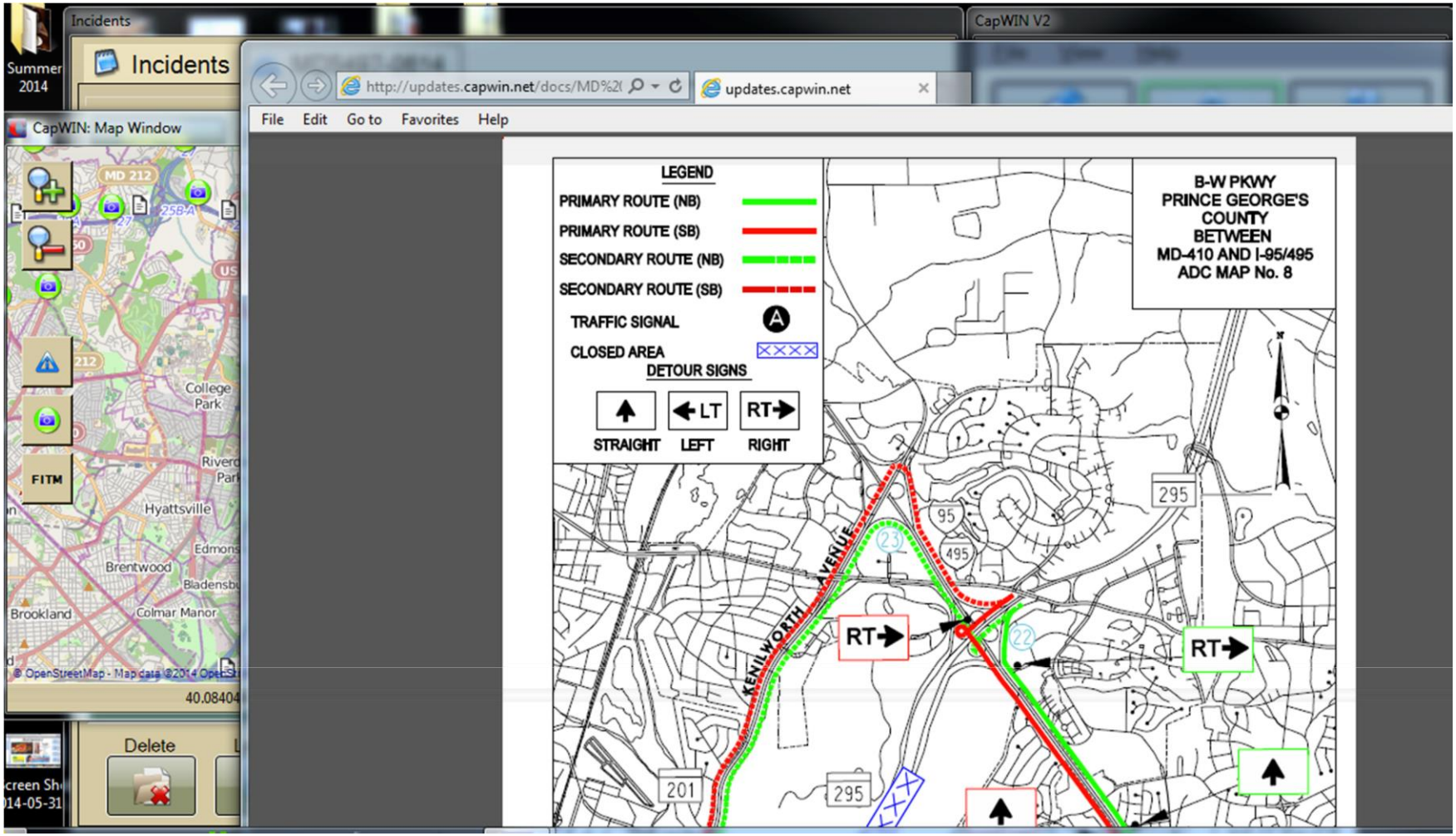
Source: University of Maryland – Capital Wireless Information Net

Figure 4-2. CapWIN Map Showing Video, Weather, Traffic and Incident Information



Source: University of Maryland – Capital Wireless Information Net

Figure 4-3. CapWIN Freeway Rerouting Layer



Source: University of Maryland – Capital Wireless Information Net

Figure 4-4. CapWIN Freeway Rerouting Plan

Chapter 5 Institutional Structures

Critical to the success of the functionality of the Information Broker as it relates to support of evacuation operations is that it be supported by an organizational structure that fosters coordination across multiple impacted agencies and jurisdictions at the local, state, and federal levels. Provided below are descriptions of existing institutional structure

Existing Institutional Structures

Management, Operations and Intelligent Transportation Systems (MOITS) Technical Subcommittee

The Management, Operations and Intelligent Transportation Systems (MOITS) Technical Subcommittee advises the National Capital Region Transportation Planning Board on matters of transportation operations and management, including considerations of Intelligent Transportation Systems (ITS) technologies in improving those operations.[11] The Subcommittee also provides a regional forum for coordination among Transportation Planning Board member agencies and other stakeholders on these topics.

Regional Integrated Transportation Information System

In the NCR, RITIS is supported through the Metropolitan Area Transportation Operations Coordination (MATOC) Program. MATOC is a partnership of Maryland State Highway Administration, District Department of Transportation, Virginia Department of Transportation, Washington Metropolitan Transit Authority (WMATA), and the Transportation Planning Board (TPB) at the Metropolitan Washington Council of Governments. MATOC was formed in 2007 based on the identified need of regional transportation officials to have a means of managing transportation incidents and emergencies from a truly regional perspective, reacting cooperatively and effectively to incidents whose effects cross state boundaries, such as crashes, extended lane closures, transit station closures, hazmat spills, or severe weather.

Since 2011, MATOC has operated under a jointly funded annual work program. The core elements of the annual work program which are still in effect today are:

- MATOC Operations Support. The purpose of this core element is to help achieve MATOC goals and objectives of coordinating regional operations through activities addressing personnel and processes and maintaining the operations of a MATOC facility at the University of Maryland Center for Advanced Transportation Technology's (UMD-CATT's) Capital Wireless Information Net (CapWIN) offices located in Greenbelt, Maryland. A MATOC Facilitator, two MATOC Coordinators, and

[11] The National Capital Region Transportation Planning Board (TPB) is the federally designated Metropolitan Planning Organization (MPO) for the region, and plays an important role as the regional forum for transportation planning. The TPB prepares plans and programs that the federal government must approve in order for federal-aid transportation funds to flow to the Washington region.

a Transportation Analyst make up the operations staff. Five days a week 16 hours a day and during special events, the MATOC Facilitator and staff exercise MATOC's standard operating procedures.

- RITIS Operations & Maintenance Support. The purpose of this core element is to provide for 24/7 Operations Support for RITIS. This involves production operations support twenty-four (24) hours per day, seven (7) days per week by full-time professional networking and software engineering staff at CATT.
- RITIS Enhancement Support. The purpose of this core element is to allow for continued RITIS enhancements based on requests that come through the MATOC Information Systems Subcommittee Change Advisory Board, from MATOC member agencies, the MATOC facilitator, and/or system enhancements for the public traveler information system web page. The MATOC Information Systems Subcommittee is charged with reviewing RITIS technical elements, reviewing and approving project documentation, acting as RITIS Change Advisory Board, and providing technical input, guidance, and recommendations to the MATOC Operations Subcommittee and the MATOC Steering Committee.
- Special Studies, Performance Measures, and Program Support. The purpose of this major work activity is to: conduct special studies; provide ongoing support for MATOC performance measure development, implementation, and reporting; and provide general program support.

CapWIN

As mentioned, CapWIN is a program located in the University of Maryland's CATT that operates under the direction of a coalition of law enforcement, fire/EMS, and transportation agencies in Maryland, Virginia, and the District of Columbia. The coalition directs CapWIN through a Board of Directors representing local, state, and federal agencies operating in all three jurisdictions, and drawn from law enforcement, fire/EMS, and transportation.[12] Appendix A provides a current listing of current CapWIN users in the District of Columbia, State of Maryland and Commonwealth of Virginia.

Institutional Structure Needs

In order to provide information on consumer's services for those using their own vehicles, agreements will need to be reached with multiple private sector entities including hotel/motel corporations, oil companies, and financial institutions, among others. Recruitment and establishment of agreements with these types of entities will be costly, time consuming and will involve multiple operational layers and legal authorities.

Further, with respect to providing ride matching, guidance, and assistance to evacuees that are mobility challenged, a significant level of operational coordination is also required. This is significant in that previous US DOT efforts, including Mobility Services for All Americans

[12] http://www.capwin.org/about

(MSAA) have tried to address the challenges associated with delivery of human services transportation that include inherent inefficiencies, limited resources and lack of coordination.[13]

Currently in the NCR there is no institutional structure in place to accommodate the vast amount of institutional coordination required of either of these functions. One option for achieving this need is to form subcommittee structures much like the Metropolitan Area Transportation Operations Coordination (MATOC), or the MOITS Technical Subcommittee.

[13] MSAA is a US DOT's initiative that has a goal of providing enhanced mobility and accessibility to all Americans through the use of technology integration, service coordination, and the efficient use of resources.

Chapter 6 Functionality Analysis

As mentioned in Section 1, high-level function requirements were previously identified for each of the R.E.S.C.U.M.E. applications. Provided below is a comparison of the requirements that have been developed for the EVAC application against the currents functions provided by RITIS and CapWIN. The comparison detailed in Table 6-1 helps to identify what functionality would need to be developed and implemented to achieve the full functionality that is envisioned for the EVAC application. It is recognized that the analysis provided in this section is specific to the NCR. Analysis of the functional capabilities of other regions throughout the U.S. will be different given differences in institutional structures, operational procedures, and technological maturity.

As can be seen in Table 6-1, RITIS and CapWIN support functions that enable public safety and transportation service providers to conduct and monitor evacuation more safely and efficiently. This is primarily due to the vast amount of information that can be shared among various agencies as part of the EVAC Communications functions.

In addition, as presented in Table 6-1, RITIS provides a subset of information that would be useful to those evacuating themselves via their own mobile device. Primarily, information such as traffic conditions is provided by transportation service providers through the EVAC Communications functions. However, RITIS, through the trafficview.org portal, does not provide consumer services information that would be a part of the EVAC Roadside Resource Identification function of the EVAC application. Nor is this group of evacuees provided the information that is envisioned for the Evacuee Return Support functions.

Further, RITIS does not currently support the EVAC functions that are needed to support those requiring assistance during an evacuation. These services would be provided through the EVAC Mobility Needs Assessment and Staging functions of the EVAC application.

Finally, the EVAC Shelter Matching function is not currently available through RITIS to support both those groups of people that are capable of evacuating themselves, and those requiring assistance.

Table 6-1. EVAC Functional Requirements Comparison to RITIS

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EVAC Communications Function				
EV-1	The Communications Function shall have the ability to receive provider-supplied data via a secure Internet connection (or other electronic equivalent communications connection).	Wi-Fi, Cellular	Yes	Yes
EV-2	The provider-supplied data will be transmitted and received in a standardized format.	Wi-Fi, Cellular	Yes	Yes
EV-3	The Communications Function shall have the capability to enable and exchange secure data transmittal of information.	DSRC, Wi-Fi, Cellular	Yes	Yes
EV-4	The Communications Function shall have the ability to transmit data from within the EVAC bundle to other Information Broker electronic systems.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline	Yes	Yes
EV-5	The Communications Function shall utilize a security protocol that is at least as secure as AES encrypted data.	Internal to application	Yes	Yes
EV-6	The Communications Function shall include the capability to receive and transmit all data related to the EVAC Application.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline	Yes	Yes
EV-7	The Communications Function shall have the ability to provide a data receipt or acknowledgement should this be requested by an information provider.	DSRC, Wi-Fi, Cellular, Landline	Yes	Yes

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-8	The Communications Function shall include the ability to manage the distribution of messages by providing data de-confliction to mitigate repeat requests, error detection, and authentication/data validation.	Internal to application	Yes	Yes
EV-9	The EVAC Communications Function should be able to integrate with existing mass warning and notification systems.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline, Internal to application	Yes	Yes
EV-10	The EVAC Communications Function shall have the ability to communicate and facilitate communication between any of the R.E.S.C.U.M.E. Bundle applications.	DSRC, Wi-Fi, Cellular, Landline	Yes	Yes
EVAC Mobility Needs Assessment and Staging Function				
EV-11	The Mobility Needs Assessment and Staging function shall have the ability to monitor identified segments of the population to maintain a situational awareness of mobility needs pre-, during, and post-evacuation.	Wi-Fi, Cellular, Radio and TV Broadcast, Landline	No	No
EV-12	The Mobility Needs Assessment and Staging function shall identify persons with mobility needs that are not being met and transmit this information to the Dispatch and Routing for Special Needs function for planning and deployment of assets.	Wi-Fi, Cellular, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-13	The Mobility Needs Assessment and Staging function shall have the ability to establish thresholds or triggers based upon various user specified criteria that are used to identify gaps between persons with mobility needs that are not being met and transportation assets.	Internal to application	No	No
EVAC Shelter Matching Function				
EV-14	The Mobility Needs Assessment and Staging function shall include the following elements that can be used to initiate a message to the Dispatch and Routing Function: • Geographic location of the person with functional needs, • Geographic location of transportation assets; • Time until evacuation ceases (pre-event) relative to time to reach the person with an available transportation asset; • Availability and capacity of transportation assets; • Mobility and transport requirements of the person with mobility needs; • Special shelter needs, availability, and capacity for the person with mobility needs.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-15	Information for the Mobility Needs Assessment and Staging function will be available in the form of one or more existing databases that contain information on persons with mobility needs.	NA	No	No
EV-16	The information from these databases will be available in a standard format.	NA	No	No
EV-17	The databases can be accessed in real-time by the Mobility Needs Assessment and Staging function.	Wi-Fi, Cellular, Landline, Internal to application	No	No
EV-18	The Mobility Needs Assessment and Staging function shall have the ability to obtain pre-evacuation information from existing and/or legacy databases.	Wi-Fi, Cellular, Landline	No	No
EV-19	The Mobility Needs Assessment and Staging function should provide database updates to existing/legacy mobility databases with newly identified persons with mobility needs.	Wi-Fi, Cellular, Landline	No	No
EV-20	The Mobility Needs Assessment and Staging function shall have the ability to receive and maintain a real-time database of persons with mobility needs that are not pre-registered, but who are identified during an evacuation.	Wi-Fi, Cellular, Landline	No	No
EV-21	The Mobility Needs Assessment and Staging function shall be able to retrieve information on mobility assets from existing data sources prior to and during an evacuation.	Wi-Fi, Cellular, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-22	The Mobility Needs Assessment and Staging function shall use information from existing/legacy mobility databases along with existing databases on mobility related assets to provide a pre-evacuation report that links persons with mobility needs to mobility assets.	Wi-Fi, Cellular, Landline	No	No
EV-23	The linking of persons with mobility needs to mobility assets shall be based upon a number of factors including: personal choice of the person with mobility needs, availability of the transportation asset, cost, and efficiency in transportation asset utilization.	Wi-Fi, Cellular, Landline	No	No
EV-24	During an evacuation, the Mobility Needs Assessment and Staging function shall maintain an ongoing database of cross-linked persons with mobility needs and transportation assets.	Wi-Fi, Cellular, Landline	No	No
EV-25	Information on the intersection of persons with mobility needs and transportation assets shall be made available to all EVAC applications in real-time.	Wi-Fi, Cellular, Landline	No	No
EV-26	The Shelter Matching Function shall include a master database of all shelters in the evacuation and surrounding areas.	Internal to application	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-27	The Shelter Matching function shall maintain real-time updates of the shelter database based upon information received from shelter providers (via the Communications Function).	Wi-Fi, Cellular, Landline	No	No
EV-28	The Shelter Matching function shall be able to interface with the American Red Cross National Shelter System database.	Wi-Fi, Cellular, Landline	No	No
EV-29	Information in the shelter database shall include: • Shelter name and address, • Status of the Shelter [open, closed, full], • Capacity remaining, • Description of the services provided by the facility, • Limitations on service [pets accepted, mobility/accessibility concerns].	Wi-Fi, Cellular, Landline	No	No
EV-30	The Shelter Matching Function shall provide recommendations to the traveling public on shelters via multiple communication methods.	Wi-Fi, Cellular, Landline	No	No
EV-31	A member of the traveling public shall have the ability to access the Shelter Matching Function via the Internet and smart phone applications.	Wi-Fi, Cellular	No	No
EV-32	A member of the traveling public should have the ability to access the Shelter Matching Function through a telephone connection point.	Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-33	The Shelter Matching Function shall provide a mechanism for the traveling public to provide information that can be used for shelter matching.	Wi-Fi, Cellular, Landline	No	No
EV-34	A member of the traveling public shall have the ability to provide information that can be used to assess shelter suitability through the Internet and smart phone applications.	Wi-Fi, Cellular	No	No
EV-35	A member of the traveling public should have the ability to provide information that can be used to assess shelter suitability through a telephone connection point.	Landline	No	No
EV-36	The Shelter Matching Function shall use, at a minimum, the following information to determine appropriate shelter matches with a traveler request: • Shelter availability, • Shelter capacity, • Requestor's current location, • Travel distance to shelter, • Modes of transportation available to reach shelter, • Need for medical support, • Number of people in the requestor's group, • Travel time to the shelter from the requestor's current location.	Internal to application	No	No
EV-37	The Shelter Matching Function shall provide at least one recommendation for a shelter for each request.	Wi-Fi, Cellular	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-38	The Shelter Matching Function should provide multiple recommendations for shelters including estimated travel times and routes to the requestor.	Wi-Fi, Cellular	No	No
EVAC Dispatch and Routing				
EV-39	The Dispatch and Routing Function will have access to a database(s) of information that contains information on the availability and capacity of transportation assets.	Wi-Fi, Cellular, Landline	No	No
EV-40	The database(s) of information on capacity and availability of transportation assets will be updated in real-time	Wi-Fi, Cellular, Landline	No	No
EV-41	The Dispatch and Routing Function will receive from the Mobility Needs Assessment and Staging Function requests for transportation assistance.	Internal to application	No	No
EV-42	Each request for assistance shall include a description of the type of resource that is requested, a timeframe for the request to be honored within, and identification of the mobility needs.	Wi-Fi, Cellular, Landline	No	No
EV-43	The Dispatch and Routing Function shall include an algorithm(s) that can identify the transportation resource assets that capable of servicing each transportation request.	Wi-Fi, Cellular, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-44	The Dispatch and Routing Function shall include a decision algorithm that can prioritize, rank, and ultimately determine which transportation asset should be mobilized to each request.	Wi-Fi, Cellular, Landline	No	No
EV-45	The Dispatch and Routing Function should employ algorithms that optimize the utilization of transportation assets.	Wi-Fi, Cellular, Landline	No	No
EV-46	The Dispatch and Routing Function shall identify a recommended route for the identified transportation asset.	DSRC, Wi-Fi, Cellular, Landline	No	No
EV-47	The recommended route shall be developed to account for the current state of the transportation system through identification of: • Traffic conditions, • Road closures, and • The persons who requested transportation assistance and are awaiting pick up.	Internal to application	No	No
EV-48	The Dispatch and Routing Function shall prepare a dispatch message with the following elements: • Time of the request, • Time of dispatch, • Recommended route, • Expected arrival time at pickup location, • Number of passengers that requested assistance at the pickup location.	DSRC, Wi-Fi, Cellular, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-49	The Dispatch and Routing Function shall receive updates on the dispatched transportation assets through the Communications Functions that provide: • Current location • Distance to the pickup location.	DSRC, Wi-Fi, Cellular, Landline	No	No
EV-50	The Dispatch and Routing Function shall use the updated information to calculate an updated estimate time of arrival to the pickup location.	Internal to application	No	No
EV-51	The updated time of arrival will be packaged as a communications message that includes: • Estimated time of arrival, • Type of transportation asset (e.g., bus, van, etc.).	DSRC, Wi-Fi, Cellular, Landline	No	No
EV-52	The communications message shall be submitted to the Communications Function for transmission to the requesting party.	Wi-Fi, Cellular, Landline	No	No
EV-53	The Dispatch and Routing Function will be able to access real-time information on road closures, traffic conditions, special transportation assets, bus schedules, and transit options.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EVAC Roadside Resource Identification				
EV-54	The Roadside Resource Identification Function will be able to access real-time information on road closures, traffic conditions, motel/hotel capacity, special transportation assets, bus schedules, and transit options.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline, Internal to application	Partial (road closures and traffic conditions)	Partial (road closures and traffic conditions)
EV-55	The Roadside Resource Identification Function will be able to access information on gasoline availability and locations, location and status of automated teller machines, food, and hotels/motels along all evacuation routes.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline	No	No
EV-56	The Roadside Resource Identification Function shall be accessible to the traveling public through an Internet connection.	Wi-Fi, Cellular, Landline	Partial (road closures and traffic conditions)	No
EV-57	The Roadside Resource Identification Function shall be accessible to the traveling public through a mobile device such as a smartphone.	Wi-Fi, Cellular, Landline	No	No
EV-58	The Roadside Resource Identification Function shall be able to receive traveler provided updates that change the status of a resource.	Wi-Fi, Cellular, Landline	No	No
EV-59	The Roadside Resource Identification Function should utilize algorithms to confirm and validate the traveler supplied information prior to reporting the updated information to other travelers.	Wi-Fi, Cellular, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-60	The Roadside Resource Identification Function shall update the status of roadside resources using updates provided from the Information Broker entities.	Wi-Fi, Cellular, Landline	No	No
EV-61	The Roadside Resource Identification Function shall update the status of roadside resources using updates provided by travelers.	Wi-Fi, Cellular, Landline	No	No
EV-62	The Roadside Resource Identification Function shall provide updates to the Information Broker indicating and describing the change in status of a roadside resource.	Wi-Fi, Cellular, Landline	No	No
EV-63	The Roadside Resource Identification Function shall obtain route information from the Dispatch and Routing Function from a Traveler's location to a roadside resource when the Traveler requests assistance in finding Roadside Resources.	Wi-Fi, Cellular, Landline	No	No
EV-64	The Traveler shall have the ability to specify the type of resource to which routing directions are desired.	Wi-Fi, Cellular, Landline	No	No
EV-65	The list of resource types shall include at least the following: Gas Station; Hotel, Transit, ATM, Bank, Grocery Store, Restaurant.	Wi-Fi, Cellular, Landline	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EVAC Evacuee Return Support				
EV-66	The Evacuee Return Support Function shall be accessible from the Internet and a mobile device.	Wi-Fi, Cellular	No	No
EV-67	The Evacuee Return Support Function shall display information on current alerts, policies, emergency levels, etc. that indicate whether an evacuee can return to their residence.	Wi-Fi, Cellular, Landline	No	No
EV-68	The Evacuee Return Support Function shall include the ability to have an evacuee type or select a specific geographic location such as a household address and provide information for that address.	Wi-Fi, Cellular, Landline	No	No
EV-69	The Evacuee Return Support Function shall utilize the Dispatch and Routing function to calculate a route for the evacuee from their current location to the geographic location of interest.	Internal to application	No	No
EV-70	The routes should be determined through using real-time information on the availability and closure of transportation roadways, and systems.	DSRC, Wi-Fi, Cellular, Landline	No	No
EV-71	The Evacuee Return Support Function shall indicate those routes that are unavailable for evacuation return to the user.	Internal to application	No	No

Table 6-1. EVAC Functional Requirements Comparison to RITIS (Continued)

Requirement Unique Identifier	Functional Requirement Description	High-Level Communication Need	Currently Accommodated by RITIS	Currently Accommodated by CapWIN
EV-72	If no available routes can be identified, the Evacuee Return Support Function shall indicate to the user that there are no safe routes that are available for their return.	Wi-Fi, Cellular, Landline	No	No
EV-73	The Evacuee Return Support Function will receive information on evacuation from a number of different sources.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline	No	No
EV-74	The Evacuee Return Support Function shall identify when it receives conflicting information from different sources on the availability of transportation assets, systems, infrastructure components, and policy/orders.	DSRC, Wi-Fi, Cellular, Radio and TV Broadcast, Landline	No	No
EV-75	If conflicting information is identified, the Evacuee Return Support Function shall submit a conflict notification message to the Communications Function to be sent to the information sources.	Internal to application	No	No
EV-76	The conflict notification message shall identify the information provided as well as the conflicting information provided by the other source.	Internal to application	No	No
EV-77	The conflict notification message shall identify the sources of the information in conflict.	Internal to application	No	No
EV-78	If conflicting information is identified, the Evacuee Return Support Function shall display the information received last.	DSRC, Wi-Fi, Cellular, Landline	No	No

Source: Battelle

Chapter 7 Considerations for Other Regions

This report has provided an analysis of RITIS and CapWIN's ability to serve as an Information Broker that supports the EVAC application. This analysis has specifically focused on how this could be accomplished in the NCR. However, it is also necessary to consider how each of these components could potentially be applied to other regions wishing to develop and implement EVAC functions. Provided below is an examination of how each component could be applied to other regions. In addition, this section provides an overview of other regions' efforts to implement functionality that can enable the concepts of the EVAC application. Provided below are other factors that facilitate the development of Information Broker and the EVAC application as a whole.

Minimal Functional Requirements

In order for the Information Broker to support the functions of the EVAC application as envisioned, it will need to accommodate a minimum range of functions which are described below. It is important to understand that nationally the entirety of these functions have not been fully accommodated within an individual region. Rather some of the functions have been implemented to meet the immediate needs of a region.

Communications

The Communications function of the EVAC application receives provider-supplied data (i.e., input data) and then transmits the generated output data to its intended data consumer quickly and securely. This includes the processes required to exchange messages with the Information Broker, the EOC, TMC, and functional needs evacuees and non-functional needs evacuees. Such processes include data receipt, data transmission and termination, data de-confliction to mitigate repeat requests, error detection, and authentication/data validation. The EVAC communications function should be able to integrate with existing mass warning and notification system data. These types of systems could include services that are registered for such as Fairfax County, Virginia's Wireless Emergency Alerts, which are part of the overall Community Emergency Alert Network (CAEN), or via a reverse 9-1-1-type information system to maximize the number of users the EVAC system can reach within a jurisdiction.[14,15]

[14] Wireless Emergency Alerts (WEA) are free informational text messages sent to WEA-enabled phones within range of an imminent and dangerous local situation, severe weather event or AMBER alert. The National Weather Service and Fairfax County are among the select entities that can send these messages to the device. The messages are sent based on your location and there is a unique sound and vibration pattern on the device for these alerts. Wireless emergency alerts are broadcast from area cell towers to mobile devices in the area. Every WEA-capable phone within range receives the message. http://www.fairfaxcounty.gov/emergency/wireless-emergency-alerts.htm

[15] Reverse 9-1-1 allows telephone notifications to be sent to residents and businesses within an area impacted or threatened by an emergency. The system utilizes 9-1-1 telephone databases, and is therefore able to contact.

One such example of a reverse 9-1-1 system is the Greater Harris County 9-1-1 Emergency Notification System. These alerts are issued by emergency management, law enforcement and fire service agencies throughout Harris & Fort Bend Counties, including the City of Houston, and delivered to both landlines and mobile phones. Emergencies necessitating these alerts could include chemical or hazardous materials releases, local area (neighborhood) evacuations, and presence of dangerous suspects. Registration is open to anyone who lives in a community that is wholly or partially in Fort Bend or Harris Counties.[16] Most of the information flowing to and from the EVAC application will flow from the Information Broker and the entities that communicate with the Information Broker.

Mobility Needs Assessment and Staging

The Mobility Needs Assessment and Staging function of the EVAC application is designed to provide information that can be used to determine the segments of the population that require assistance to evacuate themselves. This includes both persons with functional needs as well as persons without functional needs, but for whom there is an urgent mobility need as a result of the evacuation or subsequent incidents.

This component of the application is responsible for extracting information from several different databases including those databases that provide information regarding persons with functional needs, regardless of whether they have pre-registered or are identified during the evacuation (either by a responder or through self-identification). Pre-evacuation information is obtained from existing and/or legacy databases such as those maintained by state and local health and human services agencies while on-going identification of persons with special mobility needs would be gathered and provided through the EVAC application as well as from internal Information Broker entities such as a public safety answering point (PSAP), law enforcement, or some other state or local government entity.

The Mobility Needs Assessment and Staging function provides a pre-evacuation planning tool that can be used to identify those segments of the population that require assistance and geographic locations and assets that could provide that assistance. However, once the evacuation is underway, it is likely that many of the assets identified during pre-evacuation planning will be diverted to other critical needs and will be unavailable at certain points in time during the evacuation. The Mobility Needs Assessment and Staging function is responsible for monitoring the identified segments of the population to maintain a situational awareness of mobility needs, which are then passed to the Dispatch and Routing for Functional Needs function for planning and deployment of assets.

An example of where this functionality has partially been implemented is in the State of Texas. In the event of an emergency some individuals need additional assistance leaving their homes, or responding to emergency conditions by themselves. The State of Texas Emergency Assistance Registry (STEAR) (formerly the Transportation Assistance Registry) allows residents to provide information on their specific situation to emergency management officials who can help them evacuate to safety, or provide them with life-sustaining resources during times of disaster.

[16] http://www.houstonoem.org/go/doc/4027/1688791/

This information also helps emergency planners as they develop frameworks and operating procedures for assisting residents during emergencies. Any resident may register for assistance under the STEAR program if they have a condition, healthcare need, or may need additional assistance during an emergency. Some examples include:

- Individuals who have difficulty speaking English, or have any kind of disability preventing them from communicating verbally easily.
- Individuals who may need transportation assistance during an evacuation.
- Individuals who require electricity for life-sustaining equipment (such as life support machines, electric wheelchairs, or are insulin-dependent and require refrigeration).[17]

Shelter Matching

The shelter matching function provides an evacuee with a recommendation for shelters that best suit their needs such as a standard shelter, a functional needs shelter, or a shelter that accepts pets. This information may also suggest hotels/motels as potential sheltering options. The evacuee goes to a website or uses a smart phone application to put in information, such as their name, current location, number of people in their group. They shelter matching program then prompts the evacuee to answer some critical questions such as "are you evacuating with a pet?", "Is someone requiring medical support?", and the mode of transportation. Using this information along with the prevailing travel conditions and predicted shelter loads, the evacuee is matched with a shelter and the program provides the evacuee with route and traffic information.

This function will require integration with shelter availability/capability data, mapping data, traffic flow information, and weather data, similar to what is included within the American Red Cross National Shelter System (NSS). This function promotes effective movement to a matched shelter and reduces road congestion resulting from evacuees driving to and from multiple shelters that do not meet their needs. Additionally, once an evacuee is matched with a shelter, the information can be added to the Information Broker to allow for real time tracking of shelter availability.

Dispatch and Routing

One purpose of the Dispatch and Routing function is to match assistance/transportation requests with the appropriate resource, dispatch the appropriate resource, and provide the resource with the most effective route to its destination given current road/traffic conditions.

Through the Mobility Needs Assessment and Staging function, the Dispatch and Routing function is provided with requests for assistance and the type of assistance/resource needed to assist a functional needs individual or group. Once an asset is identified, a dispatch recommendation would be submitted via the Communications function to the Information Broker for processing and routing to the appropriate asset. This function provides estimated times of arrival and feedback to the individual or group requiring assistance.

In evacuation situations, some individuals will require assistance to accomplish the evacuation and will request a transportation asset to asset. However, from a system congestion and asset management perspective, it may be more beneficial to either direct the individual to the asset (rather than the asset to the individual) or provide the individual with alternatives and options for self-evacuation that may not have been previously identified or known to the individual. The Dispatch and Routing function also

[17] http://www.houstonoem.org/go/doc/4027/1130387

serves the purpose of accumulating information such as road closures, traffic conditions, special transportation assets, bus schedules, and transit options and provides this information as a planning tool and resource to evacuees through the Information Broker.

Roadside Resource Identification

This Roadside Resource Identification provides the evacuee with information on resource locations and availability (as reported by other users – not necessarily validated information) including fuel, financial services (e.g., ATMs), food, and lodging along their evacuation route. The evacuee can access this information through a Smartphone application or through another device that has an Internet connection. The application will receive inputs, via the Information Broker, from mapping/GPS resources. Users of the application can make comments through social networking tools to alert other evacuees of resource availability. For example, a user could arrive at a gas station and report that the station is out of fuel. The user who is in need of a roadside resource can select his or her need and will then be provided with a route to available resources, based upon map data and traffic/road condition data. Providing an evacuee with this type of information can help mitigate secondary events that disrupt traffic flow and prevent the additional dispatch of limited road side resources.

Evacuee Return Support

Recovering from an evacuation and returning the evacuees to a jurisdiction can be just as complex as the initial evacuation, depending on the extent of the damage. This function provides evacuees with information regarding when they can return to their area of the jurisdiction and provide recommended routes that consider road conditions (i.e., roadway infrastructure and traffic lights). This portion of the application serves as an information clearinghouse for information provided to the public by the various entities feeding into the Information Broker.

Regional Portability of CapWIN and RITIS

Although RITIS and CapWIN were originally developed in the context of the NCR, each component lends itself to potential deployments in the other regions.

Regional Integrated Transportation Information System

The CATT Laboratory operates three independent data centers and application servers with hundreds of terabytes of storage capacity. These data centers are used, in part, to collect and archive nearly 60 incoming transportation data feeds from agencies across the country. The CATT Lab is connected to these agencies via the University of Maryland's high-speed internet backbone and directly connected fiber to multiple state agencies. The CATT Lab serves this data to thousands of researchers, planners, operations specialists and homeland security officials across the country including:

- United States Office of Personnel Management,
- Unites States Senate,
- United States Capitol Police,
- State and Local Emergency Operations Centers,
- United States Army, Coast Guard, Air Force, Joint Forces Headquarters, NorthCom, National Guard,
- State and local law enforcement agencies,

- State and local transportation service providers,
- States and local transit agencies (including Amtrak),
- United States Secret Service,
- National Security Agency,
- National Oceanic and Atmospheric Administration,
- Federal Highway Administration,
- Department of Homeland Security,
- Federal Emergency Management Association,
- University research organizations,
- Transportation Security Administration Office of Intelligence,
- Metropolitan Planning Organizations,
- United States Department of Agriculture,
- United States Department of Health and Human Services,
- Pentagon Force Protection,
- United States Treasury,
- Oak Ridge National Laboratory, and
- Johns Hopkins Applied Physics Laboratory.

Similar to what has been illustrated previously in this report, it is also possible to leverage RITIS functionality and services to facilitate the development of an Information Broker to support the EVAC functions. It is important to note that similar to the NCR, RITIS users outside the NCR do not include commercial service providers which are required to enable the full functionality of the EVAC application. As such, institutional structures would need to accommodate these entities.

Capital Wireless Integrated Network

As described in Section 4, CapWIN advances data communications across agency, jurisdiction, government, and discipline boundaries. CapWIN is a set of GOTS standards-based solutions that gives users access to multiple data sources. With the goal of connecting first responders across jurisdictions, disciplines and levels of government, CapWIN's software and technical infrastructure can be easily replicated for use by other large, regional transportation sectors through the installation of additional deployment nodes. By utilizing CapWIN's "cloud" infrastructure, additional installations of CapWIN's open-source software and hardware would enhance CapWIN's reach while simultaneously hardening its current infrastructure by enabling cross-center data sharing, redundancy and disaster recovery.

As in the NCR, additional CapWIN users in other regions would be able to instantly communicate and coordinate their responses to incidents specific to their region. In addition, incident data from other transportation management systems could be easily integrated into the CapWIN infrastructure to facilitate information sharing between first responders and center-based users. Finally, with support from other state public safety agencies, CapWIN could develop interfaces to additional criminal justice data systems in order to serve mobile law enforcement data needs in those areas. It is important to note that other regions throughout the U.S. vary in terms of institutional structure, technical approach

and maturity. This will likely result in variations of deployment and operation of information sharing systems like CapWIN.

Infrastructure for Interdisciplinary Information Sharing

As mentioned, efforts have been initiated throughout the U.S. to enable the functionality of the Information Broker and EVAC application. Provided below are examples of investments that have been made in infrastructure to enable, at least in part, some of these functions.

New York Integrated Incident Management System

Critical to the success of the EVAC application will be the development, implementation and operation of a system to support information sharing across multiple disciplines and jurisdictions. This is primarily needed to support the EVAC application Communications and Return Support functions. Over the years there have been a range of systems developed to support this type of information sharing, such as in Albany, New York; Seattle, Washington; and San Diego, California among others, where law-enforcement CAD data is shared with transportation stakeholders.

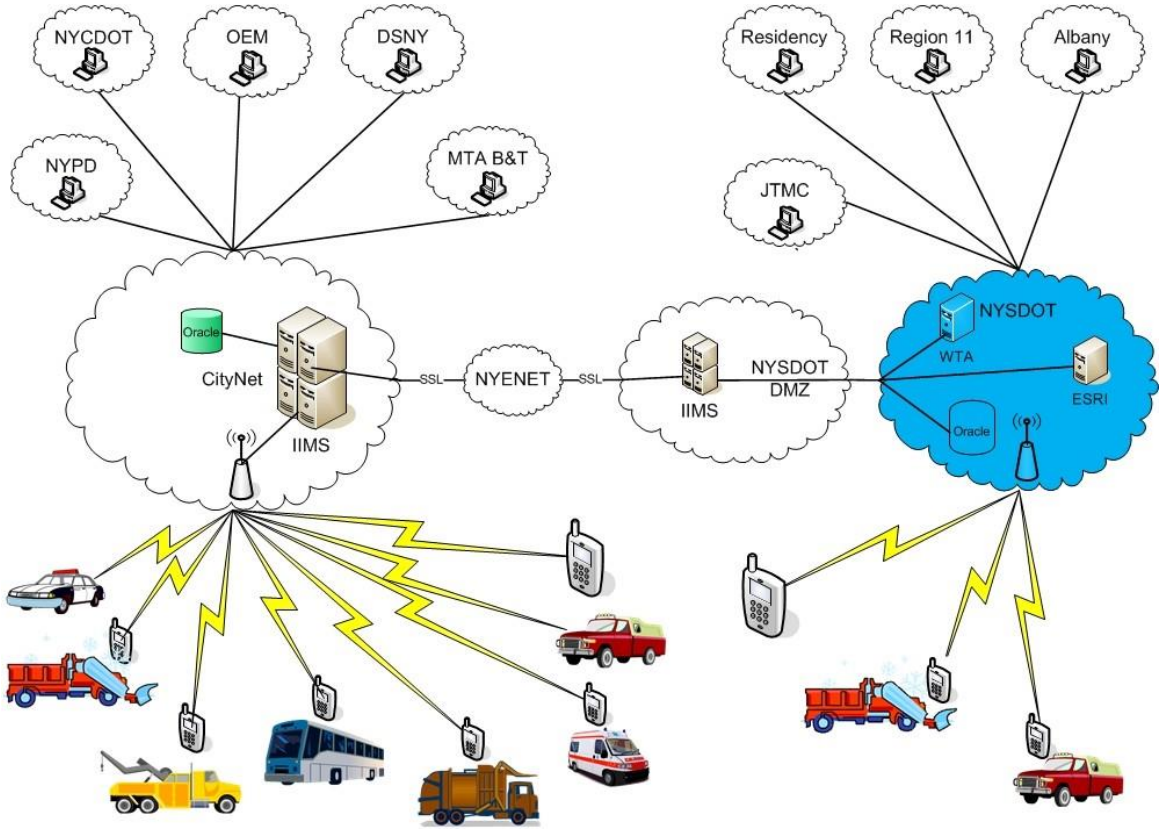
As an example, one such system is the Integrated Incident Management System (IIMS); an information sharing system managed by the New York State Department of Transportation (NYSDOT) Region 11 in partnership with the New York City Police Department (NYPD), the New York City Department of Transportation (NYCDOT), and the New York City Office of Emergency Management (NYC OEM). Although traffic incident management was the primary function, it has been enhanced to facilitate multi-agency real-time data collection and communications between:

1. On-scene responders and operations centers,
2. On-scene responders and field supervisors at dispersed locations, and
3. Operations centers.[18]

The system is being used to transmit data that describes the incident scene and includes the following: (1) textual/numeric data, (2) GPS-based responder location displayed on a GIS map, (3) GIS-based incident location, (4) digital images, and (5) delineation of area of incident impacts, lane closures, staging sites, emergency access and evacuation routes using GIS integrated with IIMS, all of which are important in supporting evacuation operations. The on-scene data is collected utilizing in-vehicle computers, digital cameras, in-vehicle video cameras, and other support equipment. Since its initial deployment, IIMS has been expanded to incorporate a wider range of users that will be connected by access to agency communication networks via workstations and laptops and through broadband wireless systems that service a wide range of mobile devices.[19] Figure 7-1 provides an illustration of the architecture that supports IIMS.

[18] Mark, Edward. *Integrated Incident Management System (IIMS) – In the New York City Area Reducing duration and severity of incidents through sharing of information between the field and center in an multi-agency system in New York City.*

[19] Amin, Rajendra, Beard, Nelson, Bruddage, Dennis, Lai, Fred, Mark, Edward, Russ, Paul. *Integrated Incident Management System (IIMS).* Presentation made to United States Department of Transportation. 19 June 2014.



Source: New York State Department of Transportation

Figure 7-1. NYSDOT Region 11 Production Architecture

As it is currently structured, similar to CapWIN and RITIS in the NCR, IIMS does not support the Mobility Needs Assessment Staging and Shelter Matching functions of the EVAC applications. Development and implementation of these functions would require additional coordination and cooperation among a range of regional stakeholders, both in the public and private domains.

Houston Transtar

The Houston TranStar consortium is a partnership of The Texas Department of Transportation, Harris County Texas, the Metropolitan Transit Authority of Harris County, and the City of Houston (including the Traffic & Transportation Group, Harris County Toll Road Authority, and the Office of Homeland Security & Emergency Management). Collectively, they are responsible for providing Transportation Management and Emergency Management services to the Greater Houston Region.[20] TranStar is unique in that it is the first major metropolitan area in the country to combine an office of emergency management with transportation managers in the same operations center which lends itself to efficiencies during emergencies, including those necessitating evacuation.

When emergency conditions arise such as hurricanes, floods, industrial explosions or terrorist attacks, the Emergency Operations Center (EOC) at Houston TranStar is activated. Representatives from all four collaborating agencies—as well as such diverse entities as the U.S. Army, Salvation Army, Harris County Toll Road Authority, Amateur Radio Operator volunteers, the American Red Cross, and area

[20] http://www.houstontranstar.org/about_transtar/. Accessed 15 October 2014.

local governments—come together to coordinate a quick, effective response. The Automated Flood Warning System, Doppler Radar Imagery, Satellite Weather Maps, Road Flood Warning Systems and the Regional Incident Management System (RIMS) comprise some of the tools used to address the emergency.[21]

With respect to evacuation operations, TXDOT provides a range of functions to facilitate the safe and efficient execution of an evacuation, including:

- Network surveillance using 71 regional hurricane evacuation cameras (on rural and/or remote routes), and
- Radar-based Vehicle Volume and Speed Detection at 28 locations on evacuation routes (primarily on rural and/or remote highway routes).

With respect to EVAC Dispatch and Routing functions, the City of Houston Office of Homeland Security & Emergency Management plays a critical role in serving people with functional access needs (formerly special needs) before and during emergencies. Individuals who need evacuation assistance can dial 2-1-1 (i.e., State of Texas Emergency Assistance Registry mentioned above) and provide their contact information and any medical needs that may require special transportation.[22]

As with IIMS and CapWIN, the entirety of the envisioned EVAC application functionality does not exist. In particular, the Shelter Matching and Roadside Resource Identification functions do not exist. Development and implementation of these functions would require the involvement of a range of additional stakeholders, both in the private and public sectors.

[21] http://www.houstontranstar.org/about_transtar/

[22] *Houston TranStar 2013 Annual Report.* Texas Department of Transportation, Harris County Texas, the Metropolitan Transit Authority of Harris County, and the City of Houston.

Chapter 8 Institutional Considerations

Given that the functionality of the Information Broker will necessitate regional partners and stakeholders to work together in new and innovative ways, a range of institutional issues will need to be considered. These issues are summarized below.

Institutional Structure and Governance

Critical to the success of the EVAC functions and Information Broker, is that it be supported by an organizational structure that fosters coordination across multiple impacted agencies and jurisdictions at the local, regional, state, and federal levels. This coordination will be necessary to develop applications that provide public agencies and individuals with technologies that foster enhanced safety and mobility. Key elements of the institutional structures may include, but are not limited to:

- Working level relationships that are supported by standard operating procedures,
- Interagency agreements that support standard operating procedures,
- Agreements with private sector entities such as consumer services providers,
- Senior level leadership and relationships among each of the participating agencies.

It is possible that existing institutional structures in some regions could be used to support some of the EVAC functions. As an example TRANSCOM is a coalition of 16 transportation and public safety agencies in the New York metropolitan region. It was created to provide a cooperative, coordinated approach to regional transportation management. It allows various user groups (i.e. the general public, commercial vendors, transportation agencies, researchers, media and others) to access TRANSCOM real-time event and travel time data for use in their applications.[23]

Closely related to institutional structures, are issues regarding the complexity, configuration, ownership, operation of data and data rights. These issues were identified by the Vehicle Infrastructure Integration Consortium (VIIC) as critical to be addressed.[24] In order to address these issues, it will be necessary for partner agencies to formalize agreements through legal mechanisms such as memorandums of understanding.

[23] TRANSCOM member agencies are Connecticut Department of Transportation Metropolitan Transportation Authority MTA, Bridges and Tunnels MTA, New York City Transit, New Jersey Department of Transportation, New Jersey Transit, New York City Department of Transportation, New York City Police Department, New York State Bridge Authority, New York State Department of Transportation, New York State Police, New York State Thruway Authority, Port Authority Trans-Hudson Corp (PATH), and The Port Authority of New York and New Jersey. https://data.xcmdata.org/DEWeb/Pages/aboutus.jsp

[24] The Vehicle Infrastructure Integration Consortium (VIIC), a consortium of nine global automakers, says work is underway to harmonize global standards for connected vehicles. http://www.vehicle-infrastructure.org/

Security and Use of Data

The functionality of the EVAC application potentially requires a range of personally identifiable information (PII) to be exchanged in real-time through an entity in the transportation environment. As an example, this could include information such as medical care requirements which can create significant challenges in securing an individual's PII.

The *Standards for Privacy of Individually Identifiable Health Information* ("Privacy Rule") (HIPAA) Privacy Rule establishes national standards to protect individuals' medical records and other personal health information and applies to health plans, health care clearinghouses, and those health care providers that conduct certain health care transactions electronically. The Privacy Rule requires appropriate safeguards to protect the privacy of personal health information, and sets limits and conditions on the uses and disclosures that may be made of such information without patient authorization. A major goal of the Privacy Rule is to assure that individuals' health information is properly protected while allowing the flow of health information needed to provide and promote high quality health care and to protect the public's health and well-being.[25] Logically, this can be interpreted to include the exchange of information evacuee needing assistance that also has medical issues that must be accommodated.

HIPPA requirements will need to be fully considered in the development and ongoing operation of the Information Broker, specifically as it relates to supporting the evacuation needs of citizens with medical conditions. Further, policies on privacy and security as it relates to law enforcement data systems will also need to be defined. Policies will the need to specifically address the restriction of safety-sensitive data, such as data from CAD systems.

Private Sector Entity Involvement

In order to provide information on consumer's services for those using their own vehicles, agreements will need to be reached with multiple private sector entities including hotel/motel corporations, oil companies, and financial institutions, among others. Recruitment and the establishment of agreements with private sector entities will involve the multiple operational layers and legal staff of each of the entities.

Operational Policies

It is envisioned that by agreement the Information Broker will be implemented as a tool to help agencies perform their functions during normal and emergency operations. It will be important that operational policies be established for the Information Broker so as the lines of legal or operation responsibilities of a participating agency are not altered. Operational policies will also need to be defined and agreed upon whereas data that is collected for processing, distribution and use through the Information Broker will remain the responsibility of the individual participating agencies.

[25] http://www.hhs.gov/ocr/privacy/hipaa/understanding/summary/index.html

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

Ongoing Operations and Maintenance

Given that the Information Broker is intended to support a range of agencies with new functionality, consideration will need to be given to how it will be operated and maintained. Partner agencies and users will need to determine how these activities will be funded, how operations and maintenance (O&M) responsibilities will be shared, and how O&M decisions will be made. These decisions will need to be made collectively under the auspice of the institutional structures that are defined to support the Information Broker. Again, it will be necessary for involved agencies to formalize agreements on these issues through mechanisms such as memorandums of understanding.

Chapter 9 Other Relevant Federal Initiatives

In addition to R.E.S.C.U.M.E., there are additional Federal initiatives that should be considered in the development of the Information Broker that supports the EVAC application. These initiatives are described below.

United We Ride

United We Ride (UWR) is a federal interagency initiative aimed at improving the availability, quality, and efficient delivery of transportation services for older adults, people with disabilities, and individuals with lower incomes. The Coordinating Council on Access and Mobility (CCAM), which is a federal interagency council established by President George W. Bush by Executive Order in 2004, oversees activities and makes recommendations that advance the goals of the Order. The goals of the Order are to simplify customer access to transportation, reduce duplication of transportation services, streamline federal rules and regulations that may impede the coordinated delivery of services, and improve the efficiency of services using existing resources.[26]

Mobility Services for All Americans

MSAA which was mentioned previously, seeks to improve transportation services and simplify access to employment, healthcare, education and other community activities by means of ITS technology. The MSAA program began in FY 2005; it was created as part of the United We Ride national campaign that implements the Executive Order on Human Service Transportation Coordination (#13330) issued by President George W. Bush in February 2004.[27]

Accessible Transportation Technologies Research Initiative

In 2013, the United States Department of Transportation launched the Accessible Transportation Technologies Research Initiative (ATTRI) to enhance mobility choice and quality for travelers with disabilities by providing the capability to reliably, safely and independently plan their travel. ATTRI is a 5-year USDOT joint research and development initiative co-led by Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) with support from Intelligent Transportation Systems

[26] Chaired by the Secretary of Transportation, the Council is composed of the Secretaries of Health and Human Services, Education, Labor, Veterans Affairs, Agriculture, Housing and Urban Development, Interior and Justice as well as the Commissioner of the Social Security Administration and the Chairperson of the National Council on Disability. http://www.unitedweride.gov/1_3_ENG_HTML.htm. Accessed 5 September 2014.

[27] http://www.its.dot.gov/msaa/. Accessed 5 September 2014.

Joint Program Office (ITS JPO) and other Federal agencies. ATTRI identifies, coordinates, develops, and implements new integrated technological solutions in advancing such capabilities.[28]

[28] http://nationalonlinedialoguetadt.ideascale.com/a/pages/backgroundonattri. Accessed 5 September 2014.

Chapter 10 Summary

The US DOT understands that there is a growing need to enhance the efficiency and safety of evacuations though the provision and innovative tools that facilitate the sharing of information for public safety and transportation officials, and evacuees – including those able to evacuate themselves using their own vehicle, and those requiring assistance. To this end, the US DOT has initiated efforts to facilitate development of innovative tools that support evacuations. Through the DMA program US DOT is sponsoring the development of the R.E.S.C.U.M.E. bundle of applications, which is inclusive of the EVAC application. Although the EVAC application is not currently being prototyped as are other applications in the R.E.S.C.U.M.E. bundle, the analysis contained in the paper provides initial steps in identifying what functionality needs to be enabled in RITIS to enable the EVAC application in the NCR.

Although RITIS does not currently include all of the functionality envisioned for the EVAC application, it represents a starting point for future development efforts as it does provide a range of functions for public safety and transportation agencies that can be beneficial during an evacuation. However, RITIS is currently limited in its ability to provide all of the EVAC functions that would be beneficial to those evacuating themselves – most notably in the provisions of consumer services that are critical to travelers during an evacuation.

RITIS also does not currently provide the functions envisioned for the EVAC application to support evacuees with functional needs. To provide these services, an initial first-step would be to widen the range of stakeholders that would need to be involved in enhancing scope of services enabled through RITIS. This could be facilitated through the institutional coordination enabled through MATOC that has been a key factor in the current success of RITIS.

It is important to note that although RITIS has been developed by UMD CATT, it currently serves this data to thousands of users nationally. This can potentially be leveraged by coalitions of state and local public safety and transportation agencies throughout the US for support of the EVAC application.

APPENDIX A. List of Acronyms

AACN	Advanced Automatic Collision Notification
AACN-RELAY	Advanced Automatic Collision Notification Relay (a R.E.S.C.U.M.E. application)
AASHTO	American Association of State Highway and Transportation Officials
ABR	Alternate Bus Routing
ALI	Automatic Location Information
ANI	Automatic Number Identification
APCO	Association of Public Safety Communications Officials
ATIS	Advanced Traveler Information Systems — or — Multi-Modal Real-Time Traveler Information (an Enable ATIS application)
ATM	Automated Teller Machine
AVL	Automatic Vehicle Location
CAD	Computer-Aided Dispatch
CAP	Common Alerting Protocol
CapWIN	Capital Wireless Information Network
CCTV	Closed-Circuit Television
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CJIS	Criminal Justice Information System
CMAS	Commercial Mobile Alert System
CMS	Changeable Message Sign
ConOps	Concept of Operations
CRS	Congressional Research Service
DACA	Deployable Aerial Communications Architecture
CV	Connected Vehicle
DBS	Direct Broadcast Satellite
DHS	Department of Homeland Security
DMA	Dynamic Mobility Applications
DMS	Dynamic Message Sign
DoD	U.S. Department of Defense
DOT	Department of Transportation

DSRC	Dedicated Short-Range Communications
DSS	Decision Support System
E9-1-1	Enhanced 9-1-1 (phone service)
EAS	(National) Emergency Alert System
ECC	Emergency Communications Center
EDR	Event Data Recorder
EMA	Emergency Management Agency
EMS	Emergency Medical Services
Enable ATIS	Enable Advanced Traveler Information Systems (a DMA bundle)
EOC	Emergency Operations Center
ePCR	Electronic Patient Care Record
ESP	Electronic Shipping Papers
ETA	Estimated Time of Arrival
ETO	Emergency Transportation Operations
EVAC	Emergency Communications for Evacuation (a R.E.S.C.U.M.E. application)
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FOIA	Freedom of Information Act
FOP	Fraternal Order of Police
FOT	Field Operational Test
FRATIS	Freight Advanced Traveler Information Systems (a DMA bundle)
GIS	Geographic Information System
GPS	Global Positioning System
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HHA	Health and Human Services
HIPAA	Health Insurance Portability and Accountability Act
HSPD	Homeland Security Presidential Directive
I2V	Infrastructure-to-Vehicle
IACP	International Association of Chiefs of Police

IAFC	International Association of Fire Chiefs
IAFF	International Association of Fire Fighters
ICS	Incident Command System
IDTO	Integrated Dynamic Transit Operations (a DMA bundle)
IEEE	Institute of Electrical and Electronics Engineers
INC-ZONE	Incident Scene Work Zone Alerts for Drivers and Workers (a R.E.S.C.U.M.E. application)
INFLO	Intelligent Network Flow Optimization (a DMA bundle)
IT	Information Technology
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MDT	Mobile Data Terminal
MMISIG	Multi-modal Intelligent Traffic Signal System (a DMA bundle)
MPO	Metropolitan Planning Organization
NAEMT	National Association of Emergency Medical Technicians
NCR	National Capital Region
NEMSA	National Emergency Medical Services Association
NENA	National Emergency Number Association
NG9-1-1	Next Generation 9-1-1 (phone service)
NGO	Non-governmental Organization
NHTSA	National Highway Traffic Safety Administration
NIMS	National Incident Management System
NOAA	National Oceanographic and Atmospheric Administration
NPI	National Provider Identifier
NRC	Nuclear Regulatory Commission
NRF	National Response Framework
NSS	National Shelter System
NTIMC	National Traffic Incident Management Coalition
NUG	National Unified Goal
NWS	National Weather Service
PDOF	Principal Direction of Force
PKEMRA	Post-Katrina Emergency Management Reform Act

PLAN	Personal Localized Alerting Network
PPD	Presidential Policy Directive
PSAP	Public Safety Answering Point
PSE	Planned Special Event
R&D	Research and Development
R.E.S.C.U.M.E.	Response, Emergency Staging, Communications, Uniform Management, and Evacuation (a DMA bundle)
RESP-STG	Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (a R.E.S.C.U.M.E. application)
RFID	Radio Frequency Identification
RITA	Research and Innovative Technology Administration
RITIS	Regional Integrated Transportation Information Systems
SCDOT	South Carolina Department of Transportation
SDARS	Satellite Digital Audio Radio Service
SOP	Standard Operating Procedure
SOW	Statement of Work
SPaT	Signal Phase and Timing
TCP-IP	Transmission Control Protocol/Internet Protocol
T-DISP	Dynamic Transit Dispatch (an IDTO application)
TIH	Toxic Inhalation Hazard
TIM	Traffic Incident Management
TMC	Traffic Management Center
TRB	Transportation Research Board
TSP	Telematics Service Provider
TTC	Temporary Traffic Control
U.S. DOT	United States Department of Transportation
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-Infrastructure or -Vehicle
VMS	Variable Message Sign
VoIP	Voice over Internet Protocol
WSP	Wireless Service Provider

APPENDIX B. CapWIN Users

Participating Agency with CapWIN		
Alexandria, Virginia Police Department	Alexandria Transit Company (DASH), Virginia Transit Agency	Allegany County, Maryland Joint Communications Center
Allegany County, Maryland Sheriff's Office	American Red Cross (National Capitol Area)	Arlington County, Virginia Police Department
Berlin, Maryland Police Department	Bladensburg, Maryland Police Department	Boonsboro, Maryland Police Department
Bowie, Maryland Police Department	Bowie State University, Maryland Police Department	Calvert County, Maryland Sheriff's Office
Camp Peary, Virginia Police	Caroline County, Maryland Sheriff's Office	Carroll County, Maryland Sheriff's Office
Carroll County, Virginia Sheriff's Office	Cecil County, Maryland Sheriff's Office	Centerville, Maryland Police Department
Cheverly, Maryland Police Department	Chevy Chase, Maryland Police Department	Christiansburg, Virginia Police Department
Central Intelligence Agency (CIA) Police	Civil Air Patrol (Maryland Wing)	Coppin State University, Maryland Police Department
Cumberland, Maryland Police Department	Damascus, Maryland Police Department	District of Columbia Emergency Management Agency (EMA)
District of Columbia Fire & Emergency Medical Services (EMS)	District of Columbia Metropolitan Police Department (MPDC)	District of Columbia Department of Transportation
Dorchester County, Maryland 911 Center	Dorchester County, Maryland Sheriff's Office	Dublin, Maryland Police Department
Easton, Maryland Police Department	Elkton, Maryland Police Department	Fairfax County, Virginia Police Department
Federal Emergency Management Agency (FEMA) National Capital Region (NCR) Coordination Center	Federalsburg, Maryland Police Department	Forest Heights, Maryland Police Department
Fries, Virginia Police Department	Frostburg, Maryland Police Department	Frostburg University, Maryland Police Department
Fruitland, Maryland Police Department	Gaithersburg, Maryland Police Department	Galax, Virginia Police Department
Galax-Grayson, Virginia Emergency Management Service	Garrett County, Maryland Sheriff's Office	Glade Spring, Police Department
Grayson County, Virginia Sheriff's Office	Greensboro, Maryland Police Department	Hampstead, Maryland Police Department
Harford County, Maryland Sheriff's Office	Hillsville, Virginia Police Department	Hurlock, Maryland Police Department
Independence, Virginia Police Department	Kent County, Maryland Sheriff's Office	Laurel, Maryland Police Department
Manchester, Maryland Police Department	Maryland Comptroller's Office	Maryland Coordination and Analysis Center (MCAC)

Participating Agency with CapWIN		
Maryland Department of Health and Mental Hygiene (DHMH) Police Department	Maryland Department of Transportation (MDOT)	Maryland Emergency Management Agency (MEMA)
Maryland General Services Police Department	Maryland Natural Resources Police	Maryland State Fire Marshal (OSFM)
Maryland State Highway Administration (MD SHA)	Maryland State Police (MSP)	Maryland Transit Administration Police (MTA)
Maryland Transportation Authority Operation Center	Maryland Transportation Authority Police (MDTAP)	Metropolitan Area Transportation Operations Coordination (MATOC)
Metropolitan Washington Airports Authority-Police (MWAA)	Montgomery County, Maryland Police	Montgomery County, Maryland Ride-On
Montgomery County, Virginia Sheriff's Office	Morgan State University, Maryland Police Department	Morningside, Maryland Police Department
Mount Rainier, Maryland Police Department	National Center for Missing & Exploited Children	Northern Virginia Community College, Virginia Police Department
National Park Service – Fort McHenry	National Park Service – Fredericksburg	National Park Service – Prince William Park Rangers
National Security Agency Police Department (NSA)	Oakland, Maryland Police Department	Ocean City, Maryland Police Department
Ocean Pines, Maryland Police Department	Oxford, Maryland Police Department	Pentagon Force Protection Agency (PFPA)
Pokomoke City, Maryland Police Department	Preston, Maryland Police Department	Prince George's County, Maryland Police Department
Prince George's County, Maryland Office of the Fire Marshall	Princess Anne, Maryland Police Department	Pulaski Town, Police Department
Pulaski County, Sheriff's Office	Queen Anne's County, Maryland Emergency Services	Queen Anne's County, Maryland Sheriff's Office
Radford City, Virginia Police Department	Ridgely, Maryland Police Department	Rising Sun, Maryland Police Department
Riverdale Park, Maryland Police Department	Rock Hall, Maryland Police Department	Salisbury University, Maryland Police Department
Smithsonian Protection Services	Somerset County, Maryland Sheriff's Office	St. Michaels, Maryland Police Department
Sykesville, Maryland Police Department	Takoma Park, Maryland Police Department	Talbot County, Maryland Emergency Management
Talbot County, Maryland Sheriff's Office	Taneytown, Maryland Police Department	Towson University, Maryland Police Department
Trappe, Maryland Police Department	United States Capitol Police	United States Coast Guard Police (Baltimore)
United States Department of Health & Human Services	United States Fish & Wildlife Service – Northeast Region	United States Marine Corps Quantico Military Police
University of Baltimore, Maryland Police Department	University of Maryland, Baltimore County, Maryland Police Department	University of Maryland, Baltimore Police Department
University of Maryland, College Park Police Department	University of Maryland, Eastern Shore Police Department	United States Park Police

Participating Agency with CapWIN		
Virginia Department of Transportation (VDOT)	Virginia State Police – Division 7 (VSP)	Washington Area Metropolitan Transit Authority (WMATA)
Waynesboro, Virginia Emergency Services	Waynesboro, Virginia Police Department	Westminster, Maryland Police Department
Wicomico County, Maryland Sheriff's Office	Worchester County, Maryland Emergency Services	Worcester County, Maryland Fire Marshal Office
Worcester County, Maryland Sheriff's Office	Wythe County, Virginia's Sheriff's Office	

Blue – Law Enforcement

Red – Fire/EMS

Green – Departments of Transportation

Black – Other Government and Non-Government Agencies

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