## 4.3 Regional ITS Concept

### 4.3.1 Regional Traffic and Transit Data Sharing and Incident Management

This concept provides for the sharing of traffic and transit information and control among traffic management centers to support a regional control strategy. This concept advances the Surface Street Control and Freeway Control by adding the communications links and integrated control strategies that enable integrated interjurisdictional traffic information sharing and control. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This concept relies principally on roadside instrumentation supported by the Surface Street Control and Freeway Control and adds hardware, software, and fixed-point to fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.

In the Metropolitan Washington Area, this concept allows traffic data sharing between RITIS/MATOC and other jurisdiction's control center. MATOC performs center-to-center communication with four agencies, MD CHART, VDOT STC, DDOT TMC and WMATA Control Center, through RITIS.

MATOC will be part of the day-to-day business practices for staff at the region's traffic management center. MATOC's functions will make use of, and be accessible through, the existing computer and communications systems of the partner agencies. It will provide a (near-) real time information of the transportation system for the ,metropolitan area, including traffic conditions, transit operations, major incidents, planned events, current and planned construction, road weather information , and other relevant data. MATOC will collaborate with and support partner agencies' TMCs in responding to regional incidents. MATOC will compile information on the current status of regional transportation network and disseminate it to the traveling public, either directly or through arrangements with partner agencies and/or private information providers.

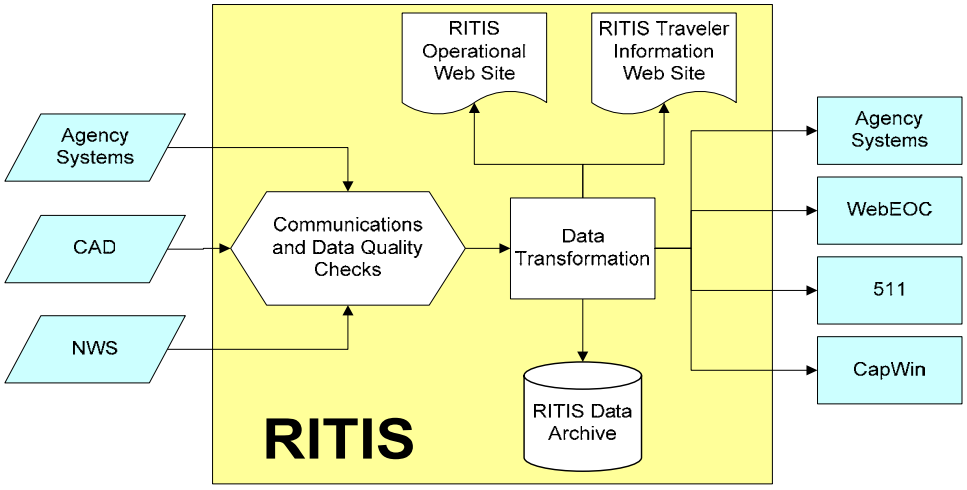


**Figure 1: Regional Traffic Data Sharing and Incident Management**

In order to achieve the regional traffic control system, it is necessary to identify stakeholders' role and responsibilities. The identification of stakeholders' role and responsibilities outlines how the traffic control will be performed in the region.

Table 1 : Roles and Responsibility of Regional Traffic Data Sharing and Incident Management

| Agency | Roles and Responsibilities |
|---|---|
| **Maryland State Highway Administration (MDSHA)** | Monitor and manage traffic on designated arterials and freeways. |
| | Coordinate traffic signal response at highway-rail intersections. |
| | Maintain centralized signal system. |
| | Install appropriate detection and dissemination devices along major corridors. |
| | Implement traffic control response to emergencies/incidents. |
| | Coordinate traffic control response to incidents with other transportation agencies. |
| | Maintain field equipment. |
| | Report and Coordinate road closures with other transportation agencies. |
| | Receive signal priority requests from transit operators (where applicable). |
| | Provide transit signal priority response (where applicable). |
| | Receive preemption requests from emergency vehicle operators (where applicable). |
| | Provide preemption response (where appropriate). |
| | Assist in coordinating traffic signals across boundaries. |
| | Share traffic information with other transportation agencies. |
| | Monitor weather conditions along roadways. |
| | Manage and monitor traffic on freeway on-ramps and highways. |
| | Manage and monitor traffic on freeways including HOV lane management. |
| | Share traffic information with other transportation agencies. |
| | Monitor weather conditions along freeways |
| | Provides the roadside elements of traffic information dissemination including DMS, HAR, and talking pedestrian signs. |
| | Collect and process automated traffic data from traffic speed monitoring sites. |
| | Monitor pavement conditions during inclement weather. |
| | Utilize current technology and strategies to optimize flow of traffic on access controlled highways. |
| | Employ strategies to improve the efficiency of operations at inter-modal transfer points. |
| | Implement algorithms for automated detection of incidents using data from roadways sensors and provide verification. |
| | Track incidents and responses. |
| | Provides emergency response plans or event plans. |
| | Provide resources when requested by emergency/incident management responders. |
| | Propose and facilitate the appropriate control of traffic signals and other traffic control to reduce the traffic flow impact of an incident. |
| | Interface with other transportation agencies to support coordinated emergency/incident response involving multiple agencies. |
| | Provide the incident manager at the emergency/incident scene. |
| | Interface with other transportation agencies to support coordinated emergency response involving multiple Agencies |

| Agency | Roles and Responsibilities |
|---|---|
| | Create, store, and utilize emergency/incident response plans to facilitate coordinated response. |
| | Propose and facilitate the appropriate dissemination of incident related information to travelers and potential travelers. |
| | Share appropriate detection and dissemination devices along major arterials with other transportation agencies. |
| | Propose and facilitate the appropriate dispatch of service vehicles to an incident. |
| | Provides for the management of reversible lane facilities, which includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. |
| | Manage regional signal timing coordination program. |
| | Provide Surveillance and Control, and maintenance of signal system. |
| | Provide communications with other systems, such as CHART, CapWIN, RITIS, etc. |
| | Maintain and operate the backup TMC, as necessary. |
| | Assist in coordinating traffic signals across boundaries. |
| **NOVA** | Operate traffic signal system within the NOVA District |
| | Monitor traffic on designated arterials and freeways. |
| | Maintain field equipment. |
| | Share traffic information with other transportation agencies. |
| | Assist in coordinating traffic signals across boundaries. |
| | Report and coordinate road closures to all relevant transportation agencies in the event of a major |
| | Receive signal priority requests from transit operators (where applicable). |
| | Provide transit signal priority response (where applicable). |
| | Receive preemption requests from emergency vehicle operators (where applicable). |
| | Provide preemption response (where applicable). |
| | Operate and maintain toll lane equipment. |
| | Monitor weather conditions along roadways. |
| | Coordinate traffic signal response at highway-rail intersections. |
| | Manage and monitor traffic on freeway on-ramps and NOVA controlled highways. |
| | Manage and monitor traffic on freeways including HOV lane management. |
| | Share traffic information with other transportation agencies. |
| | Monitor weather conditions along roadways. |
| | Operate traffic information devices on freeway (e.g. DMS) |
| | Provide resources when requested by emergency/incident management responders. |
| | Implement and coordinate traffic control response to emergencies/incidents. |
| | Provide incident detection |
| | Dispatch SSP patrol vehicles |
| | Interface with other transportation agencies to support coordinated emergency/incident response involving multiple agencies. |
| | Provide the “incident manager” at the emergency/incident scene. |
| **DDOT** | Monitor and manage traffic on designated arterials and freeways. |
| | Maintain centralized signal system. |
| | Install appropriate detection and dissemination devices along major corridors. |
| | Implement traffic control response to emergencies/incidents. |

| Agency | Roles and Responsibilities |
|---|---|
| | Coordinate traffic control response to incidents with other transportation agencies. |
| | Maintain field equipment. |
| | Report and Coordinate road closures with other transportation agencies. |
| | Receive signal priority requests from transit operators (where applicable). |
| | Provide transit signal priority response (where applicable). |
| | Receive preemption requests from emergency vehicle operators (where applicable). |
| | Provide preemption response (where appropriate). |
| | Assist in coordinating traffic signals across boundaries. |
| | Share traffic information with other transportation agencies. |
| | Manage and monitor traffic on freeway on-ramps and highways. |
| | Share traffic information with other transportation agencies. |
| | Provides the roadside elements of traffic information dissemination including DMS, HAR, and talking pedestrian signs. |
| | Implement algorithms for automated detection of incidents using data from roadways sensors and provide verification. |
| | Track incidents and responses. |
| | Provide resources when requested by emergency/incident management responders. |
| | Propose and facilitate the appropriate control of traffic signals and other traffic control to reduce the traffic flow impact of an incident. |
| | Interface with other transportation agencies to support coordinated emergency/incident response involving multiple agencies. |
| | Provide the incident manager at the emergency/incident scene. |
| | Propose and facilitate the appropriate dissemination of incident related information to travelers and potential travelers. |
| | Propose and facilitate the appropriate dispatch of service vehicles to an incident. |
| | Provides for the management of reversible lane facilities, which includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. |
| | Manage regional signal timing coordination program. |
| | Monitors traffic conditions using fixed equipment such as loop detectors and CCTV cameras. |
| | Provides monitoring and remote diagnostics of field equipment to detect field equipment failures, issues problem reports, and tracks the repair or replacement of the failed equipment. |
| | Closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, and other scenarios where access to the roadway must be prohibited. |
| | Provide Surveillance and Control, and maintenance of signal system. |
| | Provides advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance. This includes the prediction of travel demand patterns to support better lin |
| | Coordinates field equipment that is distributed along the roadway by supporting direct communications between field equipment. This includes coordination between remote sensors and field devices (e.g., Dynamic Message Signs) and coordination between the f |
| | Provide communications with other systems, such as CHART, CapWIN, RITIS, etc. |

| Agency | Roles and Responsibilities |
|---|---|
| | Maintain and operate the backup TMC, as necessary. |
| | Assist in coordinating traffic signals across boundaries. |
| WMATA | Provides emergency response plans or event plans. |
| | Dispatch police, fire, and ambulance vehicles. Provides for recording of calls, monitoring and recording of video, incident reporting to federal, state and local agencies. |
| | Interface with other transportation agencies to support coordinated emergency response involving multiple Agencies |
| | Track and manage emergency vehicle fleets using AVL technology and two-way communications with the vehicle fleet |
| | Maintain centralized emergency management system. |
| | Monitor video images and audio surveillance data collected in secure areas, including those frequented by travelers (transit stops, rest areas, park and ride lots, modal interchange facilities, on-board transit vehicles, etc.), and those typically away fr |
| | Coordinates evacuation plans among allied agencies and manages evacuation and reentry of a population in the vicinity of a disaster or other emergency that poses a risk to public safety |
| | Provide fixed route bus operations. |
| | Forwards paratransit and flexible-route dispatch requests to the operator and forwards acknowledgements to the center. It coordinates with, and assists the operator in managing multi-stop runs associated with demand responsive, flexibly routed transit ser |
| | Coordinate schedules with other transportation agencies. |
| | Track and manage fleets using AVL technology and two-way communications with the fleet. |
| | Send fleet status and location information to operations center. |
| | Provides the capability for transit vehicles to request signal priority through short range communication directly with traffic control equipment at the roadside. |
| | Provides train movement and wayside device monitoring and control, including third rail power |
| | Provide automatic train control, wayside device monitoring and control. |
| | Provides dispatch function, and tracking for bus operators. |
| | Provides automatic passenger counts. |
| | Provide means of communication with bus operators, rail operators, station managers, interlockers, depot personnel, dispatch personnel, public safety personnel, maintenance personnel. |
| | Provide SmartTrip-SMRT service that provides overall management and coordination for fare collection programs, and ridership statistics. |
| | Provide faregates, farecard vending machines, in-station and central facility fare processing equipment for rail system revenue collection and passenger counts. |
| | Provide on-bus fare boxes, garage and central fare processing equipment for fare collection and passenger counts. |
| | Monitors train movement in yards, and on mainline. Provides information about consist, railcar and train revenue and non-revenue mileage, schedule adherence. |
| | Support, implement, and operate in the regional fare management program. |
| | Collects the latest available information for a transit service and makes it available to transit customers and to Information Service Providers for further distribution. |

| Agency | Roles and Responsibilities |
|---|---|
| | Provide the interface through which transit routes (including transfer points and clusters), schedules, fares and incident information can be exchanged with other transit centers. |
| | Provides the capability to automate planning and scheduling, allowing paratransit and flexible-route transit services to develop, print and disseminate schedules, and automatically update customer service operator systems with the most current schedule. |

### 4.3.2 Regional Transit Management

The regional transit services are provided by several agencies including WMATA, which operates the metro rail and metro bus across the region. Maryland MARC train and Virginia CRE provide the rush hour commute services between Washington Dc and it's suburban. Sever local transit services such as RideOn, Arlington ART, Fairfax CUE, etc. provide the bus services primary within the local jurisdictions

The National ITS Architecture identifies several market packages for the transit services. In this area, following list is the key service area:

- Regional Transit Payment System
- Real-Time Bus Information (RTBI)
- Regional Traffic Signal Priority for Transit Buses

#### 4.3.2.1 Regional Transit Payment System

The Washington Metropolitan Area Transit Authority (WMATA) introduced SmartCard in early 1999. The SmarTrip card has achieved significant market penetration for use in the WMATA Metrorail system, associated parking facilities and WMATA's bus services. This initial success has established the foundation for implementation of a regional fare collection system to the regional transportation agencies, and beyond. This multi-jurisdictional, multi-agency regional approach will enhance customer convenience in the Metropolitan Washington Region.

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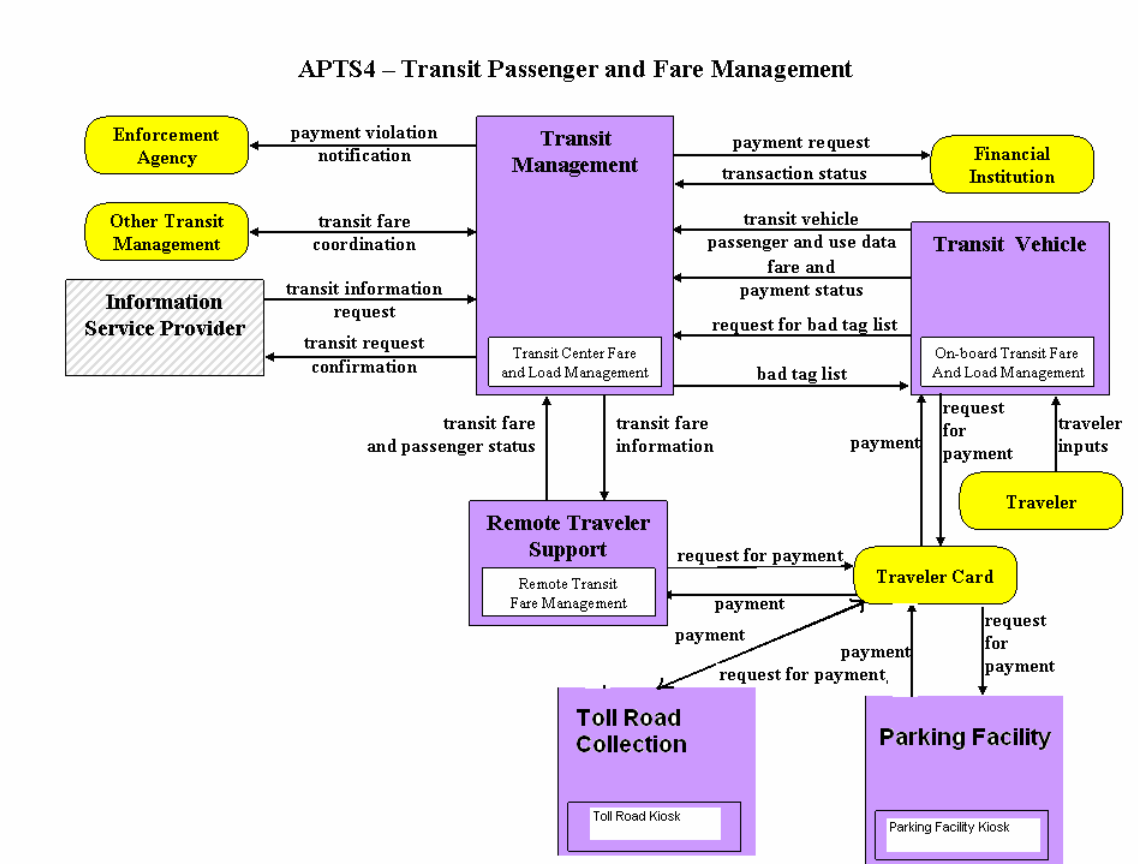


**Figure 2 Customized Regional Transit Payment System Market Package**

### 4.3.2.2 Real Time Bus Information

The Real Time Bus Information (RTBI) Programs supports the provision of collecting, processing, disseminating and presenting information on Metrobus schedule status to various customer groups. The key customer is the Washington Metro area transit user and potential user (i.e. traveler). Other customer include :

- Regional transit agencies
- Regional multimodal transportation providers
- WMATA staff including Senior Managers, BOCC, BUSV
- Local Media and pres
- Archive Data User

The program scope deals only with real-time bus schedule status information. Real-time incident information is closely coupled with the rail mode and leverages incident information from other areas as Metro.

The ITS Market Package that cover this program is the *Transit Traveler Information*.

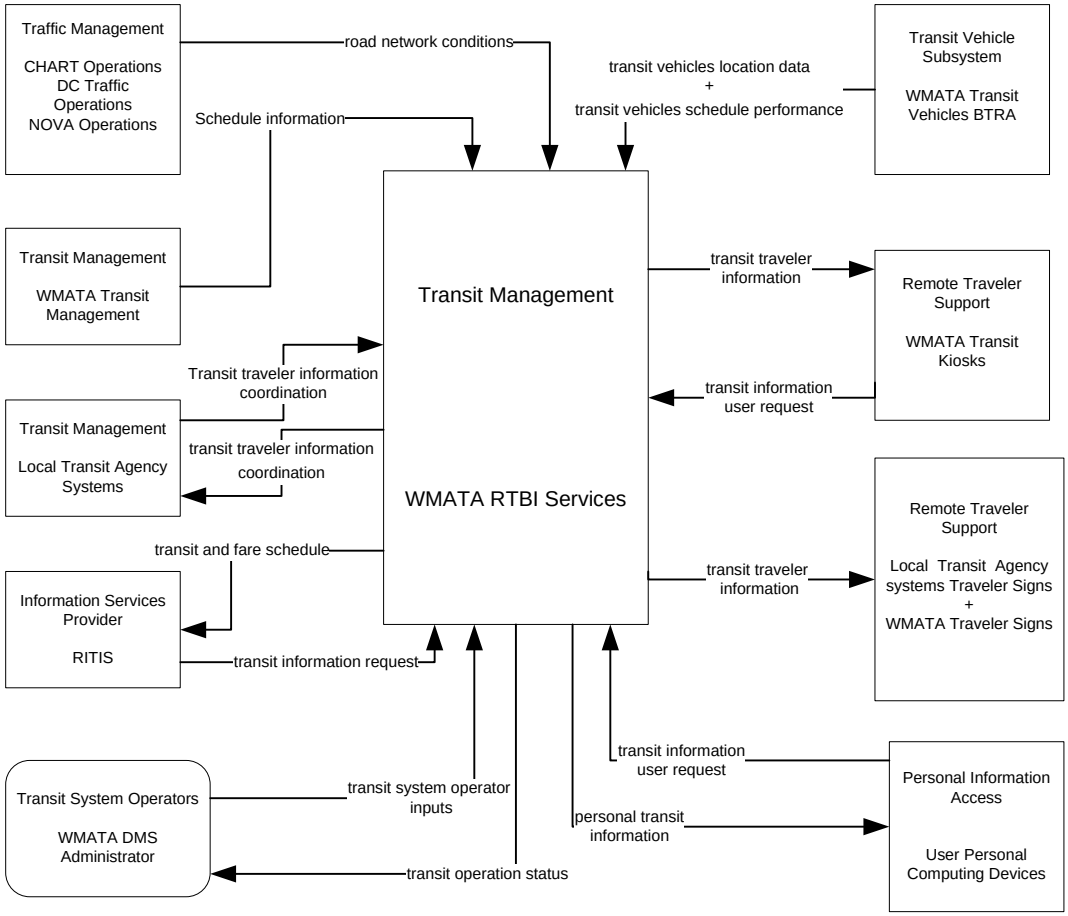


**Figure 3 Customized WMATA RTBI Market Package**

### 4.3.2.3 Regional Traffic Signal Priority for Transit Buses

Implementation of Transit Signal Priority (TSP) has resulted in significant improvement in transit system operations for several agencies. Implementation of TSP is considered as a mean to archive the following specific objects:

- increase transit on-time performance by reducing travel time variability and
- increase transit travel speeds by reducing delay at traffic signals.

The implementation program will result in benefits to the transit riders and reduce overall person delay, while remaining transparent to other vehicles.

A TSP system will be comprised of three components: (1) traffic signal controller and a signal priority algorithm (typically implemented by the local traffic controller), (2) a detection system, and (3) support system that will monitor the preference of the transit vehicle and traffic signals.

Based on the existing roadside equipment (signal system) and on-board vehicle equipment, and use of the NTCIP 1211 standard, the process to develop a high-level design of a signal

priority system results in two distinct TSP system alternatives : a Distributed system, and a Centralized System.

A distributed priority system is where the priority request is generated on the fleet vehicle and is detected and served at the local traffic signal controller. The centralized priority is where the priority request is generated either at transit management center or the traffic management center (TMC). The message is transmitted to priority request server, located at TMC. Priority is granted on the local controller level based on direction from TMC.

The ITS Market Package that cover this program is the *Multimodal Coordination.* This Market Package contains elements from both a distributed and centralized priority system, setting the groundwork for a integrated system in the region.

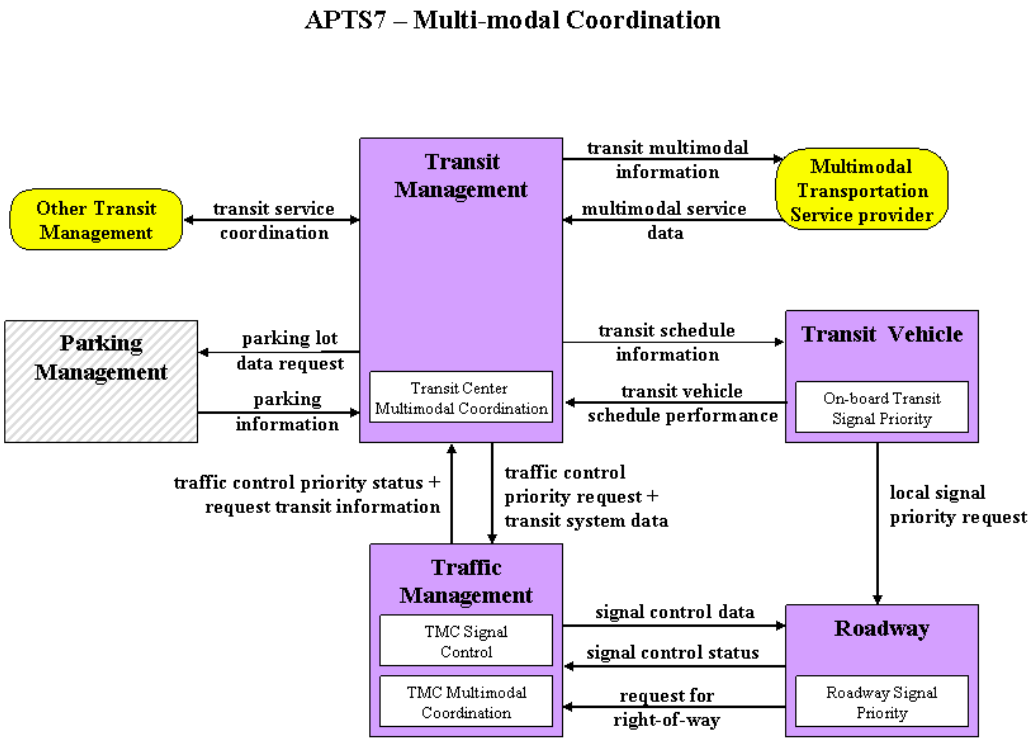


**Figure 4 Multi-modal Coordination**

Following table 2 outlines the roles and responsibilities of agencies involved in the regional transit services in the Metropolitan Washington Area.

### 4.3.3 Regional Traveler Information (511)

#### 4.3.3.1 Feasibility of Metropolitan Washington Area 511

The Metropolitan Washington Region faces a number of issues regarding traveler information. The Partners in Motion project expires in December 2002 and public sector representatives need to explore options and make appropriate choices and decisions

regarding what traveler information services to provide, how to provide them. As matter of fact, 511 is feasible in the Washington, DC metropolitan area. Data and information is available to help travelers make better decisions. There will be a regional information sharing database (RITIS) with a standardized output and an organization (MATOC) willing to take on operational responsibility.

The vision developed by the Committee for the Washington metropolitan area 511 was based on the national 511 vision:

> *The Washington metropolitan area 511 is a customer-focused, multimodal traveler information service available across the region via phones, the Internet and other personal communication devices. The Washington metropolitan area 511 system will be interoperable with neighboring 511 systems resulting in a more satisfactory travel experience.*

#### 4.3.3.2 511 National Update

On March 8, 1999, the U.S. Department of Transportation (USDOT) petitioned the Federal Communications Commission (FCC) to designate a nationwide three-digit telephone number for traveler information. On July 21, 2000, the FCC designated 511 as the national traveler information number.

The FCC ruling leaves nearly all implementation issues and schedules to state and local agencies and telecommunications carriers. There are no federal requirements and no mandated way to pay for 511. Consistent with the national designation of 511, the FCC expects that the transportation industry will provide the traveling public with a quality service that has a degree of uniformity across the country.

In early 2001, mindful of both the opportunity and challenge that 511 presents, the American Association of State Highway and Transportation Officials (AASHTO), in conjunction with many other organizations including the American Public Transportation Association (APTA) and the Intelligent Transportation Society of America (ITS America), with the support of the USDOT, established a 511 Deployment Coalition. An executive-level Policy Committee and a supporting Working Group were established to conduct the work of the Coalition. Membership of the Coalition draws from all levels and types of government agencies, various segments of the telecommunications industry and the fields of consulting, system integration and information service provision.

The goal of the 511 Deployment Coalition is that 511 will be a customer driven multimodal traveler information service, available across the United States, accessed via telephones and other personal communications devices, realized through locally deployed interoperable systems, enabling a safer, more reliable and efficient transportation system.

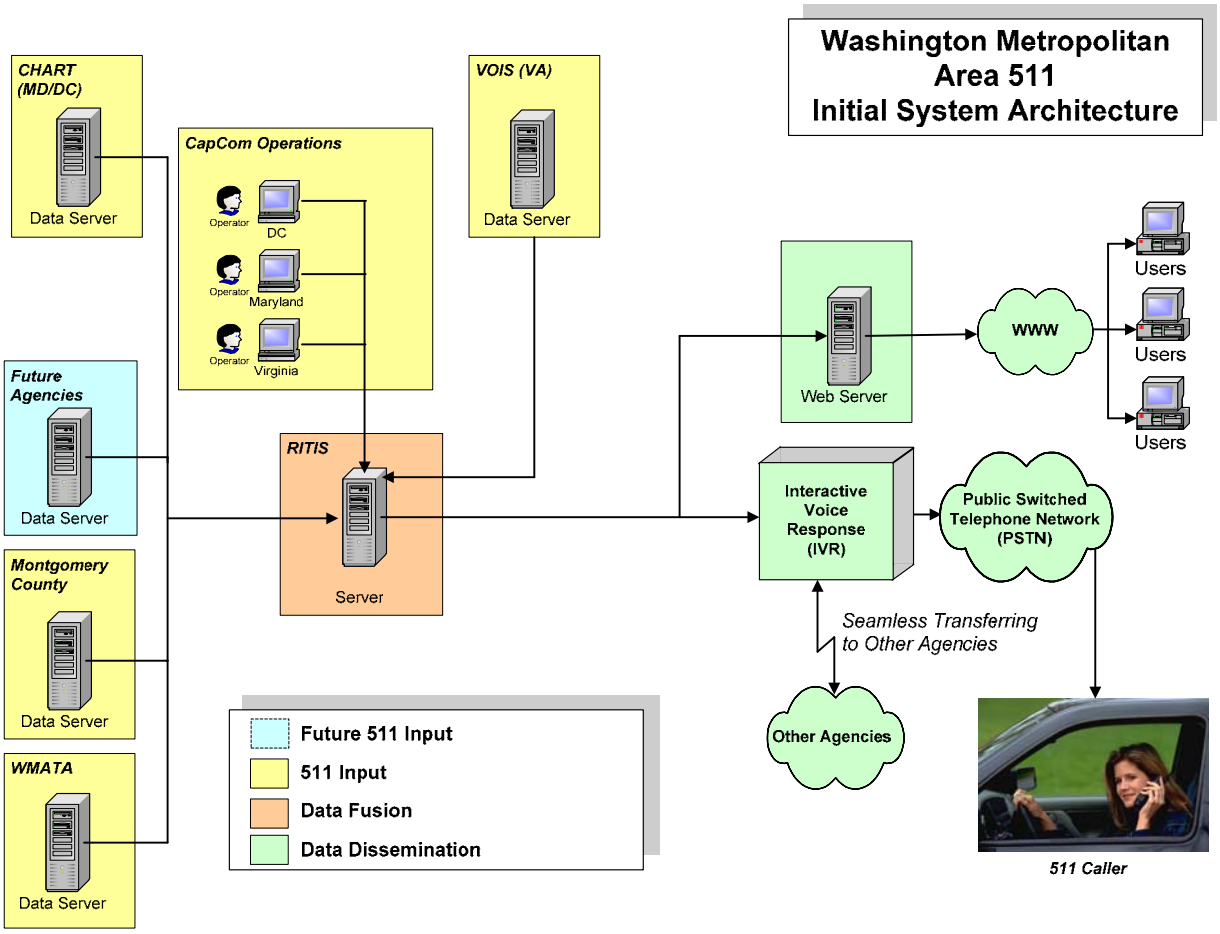


**Figure 5**

### 4.3.4 Regional Emergency Management

The emergency management represents public safety, emergency management, and other allied agency systems that support incident management, disaster response and evacuation, security monitoring, and other security and public safety-oriented ITS applications. It includes the functions associated with fixed and mobile public safety communications centers including public safety call taker and dispatch centers operated by police (including transit police), fire, and emergency medical services. The emergency Management also represents other allied systems including centers associated with towing and recovery, freeway service patrols, HAZMAT response teams, and mayday service providers.

The emergency management interfaces with other Emergency Management Subsystems to support coordinated emergency response involving multiple agencies. The subsystem stores, coordinates, and utilizes emergency response and evacuation plans to facilitate this coordinated response. As the response progresses, situation information including damage assessments, response status, evacuation information, and resource information are shared to keep all allied agencies appraised of the response. Interface with the Transit Management Subsystem allows coordinated use of transit vehicles to facilitate response to major emergencies and to support evacuation efforts. The Emergency Management Subsystem also provides a focal point for coordination of the emergency and evacuation

information that is provided to the traveling public, including wide-area alerts when immediate public notification is warranted.

The emergency management tracks and manages emergency vehicle fleets using real-time road network status and routing information from the other center subsystems to aide in selecting the emergency vehicle(s) and routes that will provide the most timely response. Interface with the Traffic Management Subsystem allows strategic coordination in tailoring traffic control to support emergency vehicle ingress and egress, implementation of special traffic restrictions and closures, evacuation traffic control plans, and other special strategies that adapt the transportation system to better meet the unique demands of an emergency.

An effective emergency management plays an important role in transportation management and operation in the Metropolitan Washington Area. It requires data sharing between various transportation agencies and emergency management agencies. It includes managing both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. Figure 6 illustrates the regional emergency management in the Metropolitan Washington Area.

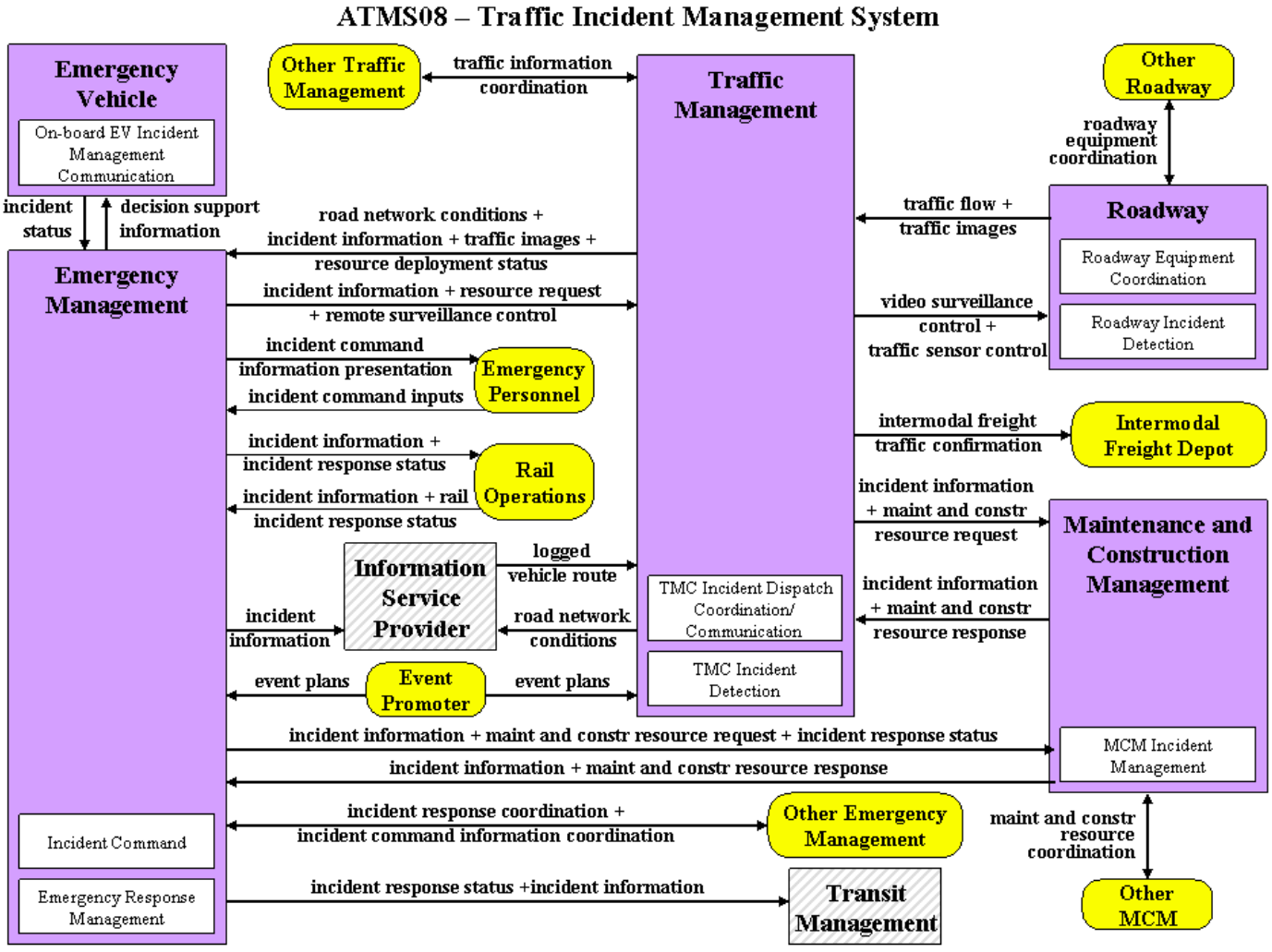


**Figure 6**

### 4.3.5 Regional Archive Management

#### *4.3.5.1 RITIS Archive Concept*

This concept includes all the data collection and management capabilities provided by each jurisdiction in the region, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this concept in addition to the basic query and reporting user access features offered by the individual jurisdiction archive capabilities.

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

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

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

#### *4.3.5.2 RITIS Archive Functionalities*

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

Archived data will serve as a rich source for both traditional and innovative regional transportation analyses and as a valuable record of decisions made and actions taken for incidents and other scenarios in the region. This function will allow users to better use the system and respond to or manage future transportation scenarios. Additional archived data uses might be transportation planning, transportation system performance monitoring, accident prediction modeling, incident detection, roadway impacts, construction impacts, air quality analyses, transit management, and emergency planning. The RITIS archived data user service (ADUS) web site will provide users with a cost effective, on-demand, one-stop shop for multi-agency, multi-disciplinary, multi-jurisdictional data continuously accumulated from sources across the region. All RITIS data except CCTV video and weather radar data

will become part of the data archive. Data retention periods have not yet been established. Archived data may also be used operationally. Automated alerts can be established to inform users of network conditions that deviate from the norm, indicating a possible incident.

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

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

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

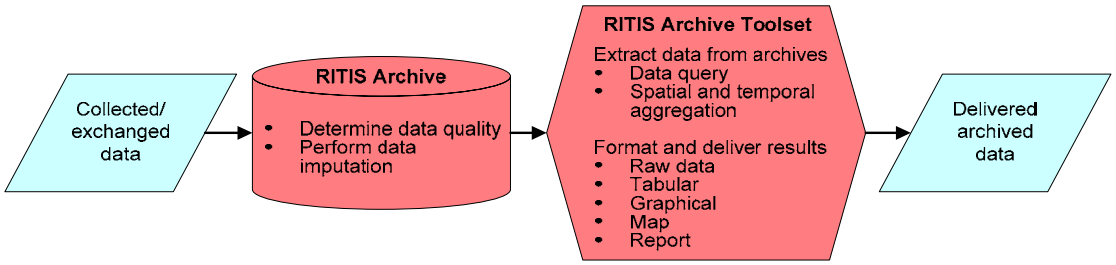


**Figure 7**

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

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

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

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

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

- three-dimensional (3D) data query and spatial/temporal graphing visualization tools; 3D traffic data graphing allows users to query the RITIS incident databases to graph incident statistics, derive performance measures, and create timelines of individual incidents.
- detector health visualization tool
- data extraction and query tools which will enable users to query for specific data and extract that data for analysis
- predetermined reports on regional transportation statistics the ability for users to generate their own ad hoc queries
- real-time and archived incident information and status

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

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

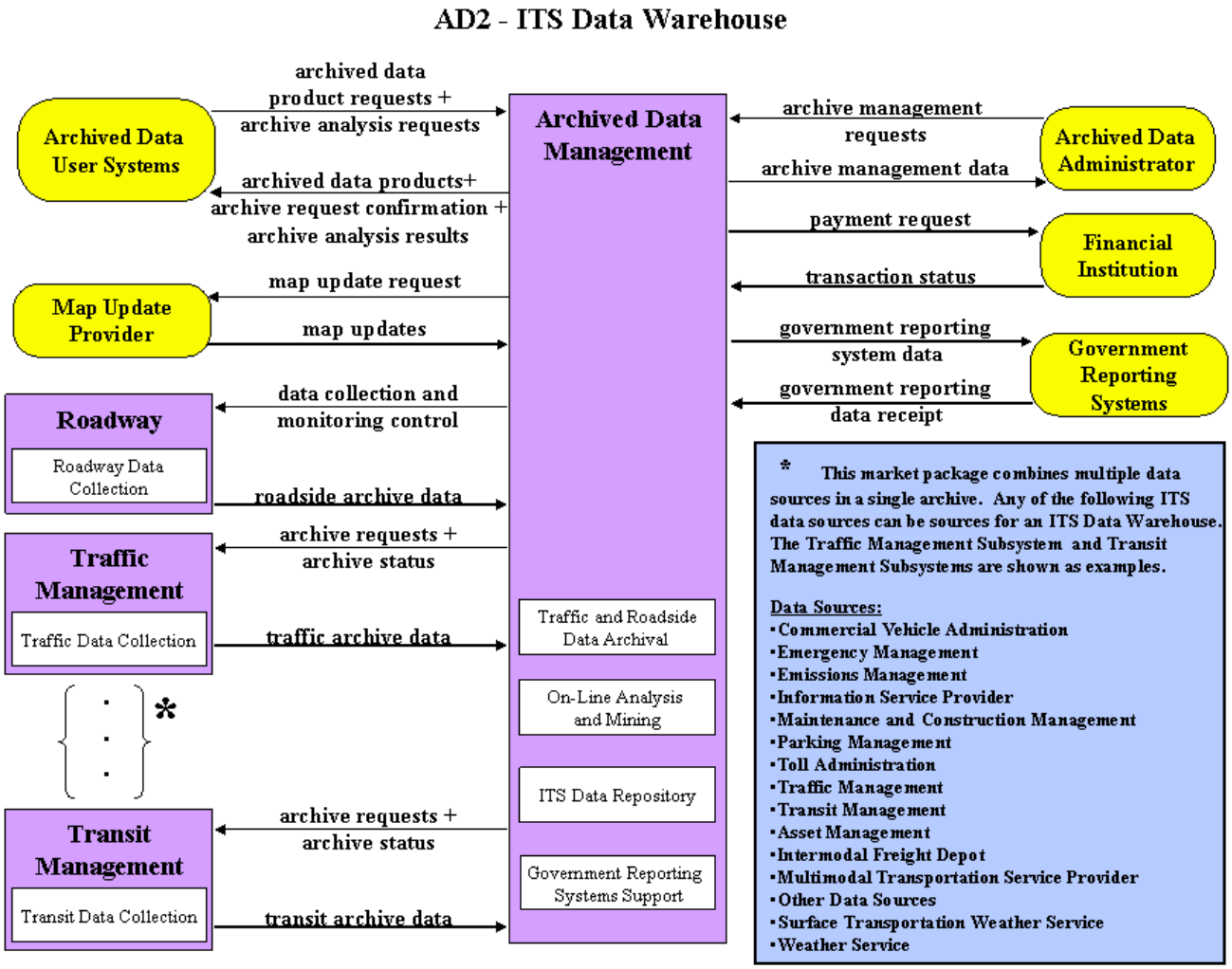


**Figure 8**

Following table outlines the participated agencies in the regional archive concept and their roles and responsibilities.