On-Call ITS / Safety / Operations Contract 151-BLW

Task 02: Northern Virginia Task Support
Subtask D: Program Plan Update

NOVA SMART TRAVEL PROGRAM PLAN UPDATE

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ITS Program Plan
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1 INTRODUCTION

This document summarizes the Virginia Department of Transportation Northern Virginia District (NOVA) Program Plan for Intelligent Transportation Systems (ITS), or the "NOVA Smart Travel" Program. The NOVA program resides within the context of the broader, statewide VDOT Smart Travel Program. Key elements of the NOVA Smart Travel Program include the Smart Traffic Center (STC)[1] and field infrastructure such as variable message signs (VMS), closed-circuit television cameras (CCTV), and the Safety Service Patrol (SSP)[1].

The Program Plan identifies:

- The overall NOVA Smart Travel Vision
- Goals and objectives
- ITS-related needs identified by stakeholders
- A regional operating concept showing the major ITS roles and responsibilities of NOVA and how they interact with their ITS partners
- Guidance on developing ITS projects consistent with the NOVA Smart Travel Program
- A proposed process for evaluating and prioritizing candidate ITS projects

The Program Plan is a companion document to the NOVA ITS System Architecture. The system architecture builds on the overall direction and high-level agency interactions (also known as the regional operating concept) identified in the Program Plan. It provides additional technical detail regarding interactions among organizations, including specific data to be exchanged to support coordinated operations.

The broader context for the NOVA Program Plan is as an action of the overall, statewide VDOT commitment and approach to systems operations, including ITS. System operations is a core VDOT function. VDOT's overall, statewide strategy has undergone a dramatic change in the last few years from a two-pronged "build-maintain" strategy to a three-pronged "build-*operate*-maintain" strategy. VDOT is rapidly evolving into a customer-driven organization with a focus on outcomes and a "24/7" performance orientation. VDOT's new focus is to actively manage the transportation system to maximize safety, security, mobility, and return-on-investment for the benefit of customers. VDOT is looking at new business models, emerging technologies, and best practices to fulfill these objectives.

In addition to responding to the recent statewide VDOT emphasis on operations and the utilization of advanced technologies, the NOVA Program Plan also takes into account the current Federal ITS program emphasis. Several major changes have taken place in the past year and more changes will occur as a result of the recently enacted transportation act (SAFETEA-LU).

[1] Throughout this document, the terms "STC" and "SSP" refer specifically to the *NOVA* STC and *NOVA* SSP, unless otherwise specified.

Provisions of importance in the Act to the NOVA Smart Travel Program include the continuation of the trend toward "mainstreaming" ITS, evidenced by less dedicated ITS funding, with more ITS programmed into construction and operations; emphasis on real-time information, architecture, and data exchange standards; increases in university-based research; and major program initiatives.

Under SAFETEA-LU, the United States Department of Transportation (USDOT) ITS Program includes fewer, larger, higher-risk, high-payoff "major initiatives." The nine major initiatives are:

1) Integrated Vehicle-based Safety Systems
2) Cooperative Intersection Collision Avoidance Systems
3) Next Generation 911
4) Integrated Corridor Management Systems
5) Mobility Services for All Americans (including social service transit coordination)
6) CLARUS (weather information sharing)
7) Emergency Transportation Operations
8) Universal Electronic Freight Manifests
9) Vehicle Infrastructure Integration

Although the nine major ITS initiatives do not account for the entirety of the Federal ITS program, they are a major component and offer a clear indication of the general direction of the program. Certainly the initiatives provide an indication of the types of activities which are likely to be viewed most favorably for funding and political support. As NOVA pursues their ITS strategy, it is important to remain aware of the Federal program direction and to look for areas of synergy and opportunity.

2 NOVA SMART TRAVEL VISION

The NOVA Smart Travel Program Plan envisions that:

> *"Intelligent Transportation Systems make travel "smart" through technology, as well as through automated, streamlined agency processes and procedures."*

NOVA Smart Travel is geared toward providing better services to NOVA customers by improving the quality of their travel and responding promptly to their issues. The focus is on attaining operating efficiencies from the existing roadway infrastructure as a compliment or alternative to building additional capacity. The NOVA Smart Travel Vision is as follows:

> ***"****Integrated deployment of Intelligent Transportation Systems will help NOVA optimize its services, supporting a secure multimodal transportation system that improves quality of life and customer satisfaction by ensuring a safer and less congested transportation network."*

2.1 Implications of the Vision

Guided by the vision, NOVA will implement and utilize a range of advanced technologies and increase the level of coordination between various stakeholders in the region in several key areas. The NOVA Smart Travel Vision includes the management and operations of systems that are in place or will be realized in the next 10 years: systems which enable NOVA to enhance agency operations, to manage resources more effectively, and to improve services provided to the NOVA Smart Travel system users.[2] The NOVA Smart Travel Vision will be translated into specific activities organized around a few key areas of activity, as explained in the paragraphs that follow. Realization of the overall NOVA Smart Travel Vision, and execution of the activities that will occur as part of the vision, will be driven by the goals, objectives and strategies presented in Section 4.0.

Following are descriptions of the various elements of the NOVA Smart Travel Vision. That vision describes NOVA ITS operations as they are intended to be within approximately 10 years. Some of the technologies and activities that are described in the vision are currently in place and the others are intended to be in place within the 10-year horizon of this Program Plan. The vision elements do not distinguish between existing and future technologies and activities, but rather, describe all of the technologies and activities as they will be by the end of the 10-year planning horizon.

[2] The term "users" applies to more than those who simply receive a benefit from these operational areas. Users are those groups who have a stake in the success of the transportation system. This includes motorists, transit agencies, emergency services, trucking companies, and the NOVA District, to name a few.

Managing Traffic – Surveillance equipment placed on the major corridors will provide real-time data to a central transportation management center (the NOVA STC) where software systems and staff will process it to assess the state of the system and identify problems throughout the entire network. The NOVA STC will monitor traffic flow, high-occupancy vehicle (HOV) operations, ramp meters, and other technology intended to enhance the operational capacity and throughput of the facilities in the NOVA area. The NOVA STC proactively manages traffic congestion by controlling ITS field devices and informing travelers of alternative routes in advance of congested areas.

The STC manages the roadway network as a whole and does not focus exclusively on interstates. In such a corridor-based approach, arterials that parallel interstates are treated as a "corridor" for traffic management. Coordination with signal systems allows highway managers to more effectively utilize arterial streets as diversion routes. Along with signal coordination, maintenance and construction information is shared on an accurate and timely basis between STC and other information service providers to minimize the disruption to traffic.

Seamless coordination between public safety agencies, adjacent VDOT districts, VDOT Central Office, District of Columbia, and Maryland will ensure that the NOVA STC is aware of situations on the entire surrounding transportation system. A developing regional coordination body called CapCOM (Capitol Region Communications and Coordination) is intended to gather data from agencies or other sources to enable and provide a "big picture" of regional traffic. CapCOM will coordinate with Transportation Management Centers (TMCs) such as the STC when those TMCs are responding to local incidents that have the potential to escalate toward regional implication. CapCOM also provides the capability of disseminating these traffic and incident data throughout the Washington D.C. Region. Similarly, the VDOT Virginia Operations Information System (VOIS), or a similar system, will provide the data to VDOT departments throughout the state.

A critical part of managing traffic is signal operations. NOVA's existing Smart Traffic Signal System (STSS) controls and optimizes signals on state roads in the NOVA region. All signals within this network are monitored to ensure that the signal timing is optimal to provide safe and smooth traffic flow. A recent Washington Post article tested signals on Rt. 7 in the NOVA District and found that incidents can be reduced through changes to the signal timing practice.

Managing Incidents – Minimizing the impacts of incidents and traffic disruptions remains a top priority for the District. Effective incident management can be achieved through improved coordination and communication between incident management agencies. Eventually, the NOVA STC, STSS, and State Police dispatch staff will be co-located with Fairfax County 911 call-takers, fire and police dispatch, and emergency management personnel in the Public Safety and Transportation Operation Center (PSTOC). This will enable swift incident detection and verification followed by a coordinated response. Computer-aided dispatch (CAD) integration between STC and law enforcement agencies minimizes duplication and information exchange requirements. Enhanced cooperative emergency planning, improved emergency response protocols, training for NOVA's public safety partners, and preplanned recovery procedures are

in place to minimize risk and improve recovery after major emergencies. NOVA will work with other agencies to allocate and dispatch internal and external resources (e.g., trucks, cones, people, signs, etc.) for emergency response and recovery operations.

The SSP will work with local police/fire and other agencies to remove incidents from the roadway in the shortest time possible on all the major corridors. The SSP will provide the STC with information on local trouble spots, which the STC will evaluate as potential areas for physical improvements or technology deployment. SSP coordinates closely with the STC and personnel from both groups function as a unified team in managing traffic and incidents. SSP and STC use technology for enhancing their communications (by voice and data) in working as a team.

Automated Vehicle Location (AVL) systems will play a key role in identifying and coordinating SSP resources. AVL will enable SSP managers to efficiently utilize their resources and will also assist STC personnel in directing resources to where they are most needed.

SSP units and personnel should also be able to receive roadway conditions information from STC (camera images and congestion maps) while in the field. In addition, coordination is needed with local police who use an automated crash reporting system, which includes automated location identification technology to improve incident reporting.

Travelers themselves can continue to report incidents through cellular telephones. NOVA will facilitate public safety agencies' response to incidents by providing signal priority to their en-route vehicles and by sharing route congestion and lane closure data so their vehicles are impeded as little as possible by traffic.

Providing Real-Time Information to Users and Utilizing Archived Data – Real-time roadway status will be available to motorists through the Internet, 511 phone system, Integrated Voice Response (IVR) systems, communications with personal devices, and NOVA's customer service activities. Additionally, NOVA will investigate the possibility of posting real-time travel times and other real-time information on variable message signs.

Types of real-time information that will be disseminated include travel times, traffic conditions, video images, and construction activities. With help from regional bodies like CapCOM, NOVA will help, along with other transportation organizations and private sector information providers, provide travelers with enhanced travel information for the entire NOVA region.

In-vehicle "Mayday" systems will allow quick and automated identification of disabled vehicles and serious accidents in remote areas. When triggered by a serious crash, or activated by the driver, the location of the event will be communicated to an Information Service Provider (ISP) who will then forward the information to local emergency services and NOVA. The local emergency service will send appropriate help to the affected vehicle and NOVA will support the effort by managing the traffic at the location of the incident.

With the ITS infrastructure in place, NOVA will use traffic operations data such as speed, classification, and volume that are used for traffic management and evaluation, for other activities, such as Archived Data Management System (ADMS) and planning activities.

Managing Infrastructure – A robust inspection and maintenance program is in place for the freeway management system that is results-based and focused on condition assessment and operability of a variety of ITS systems and devices, including telecommunications. Automatic Vehicle Location technologies and database management systems will improve the deployment of equipment (trucks, vehicles, tractors, etc.) needed to maintain the transportation system. Supervisors will know exactly what maintenance equipment is available and where it is located, thus improving dispatch efficiency. Fleet management capabilities, coupled with weather and pavement-monitoring capabilities, will enhance roadway management during adverse weather conditions.

Encouraging Transit and Multimodal Use – Several transit agencies are provided signal priority where appropriate. Traffic information is provided to the transit providers so they can assess their schedule reliability and reduce travel time. This traffic information may also be relayed to the public who are considering travel via transit. Safety at transportation facilities is ensured by establishing automated mechanisms to detect activities and/or motorist/pedestrian distress at Park-n-Ride facilities and rest areas. Detected traveler distress will be communicated directly to the Virginia State Police and/or other emergency service providers.

Special transit information may be conveyed to motorists at strategic locations through variable message signs and highway advisory radio to encourage transit and multimodal use and therefore reduce traffic demand. Additionally, private information service providers will provide packaged information through in-vehicle devices, dial-up services, personal digital assistants, Internet, television, and radio stations.

Park-n-Ride lots will be monitored for lot availability and security and status information will be shared with travelers.

Unified Toll Operations – A unified toll tag is currently usable throughout Virginia and the member states of the I-95 Corridor Coalition. Similarly, electronic toll tags used by the I-95 Corridor Coalition states will be usable throughout Virginia. Traffic data extracted from toll tag information will be provided to the STC for traffic flow analysis and travel time estimation. Additionally, a simplified method of payment will be available that is particularly beneficial to those who travel using a combination of car, bus, or train. Fare and fee collection for travel will be automated, thus reducing the time spent making the fare/fee payment.

3 STAKEHOLDER NEEDS

The NOVA Smart Travel Program is oriented to meeting the needs of a wide range of stakeholders, including various types of travelers (commuters, recreational travelers, commercial vehicle operators, etc.), transportation agencies, emergency responders, and other organizations that play major roles in, and are impacted by, transportation operations.

A wide range of technical and institutional needs and issues have been repeatedly expressed in the NOVA region. These needs were expressed over time in one or more NOVA meetings, Metropolitan Washington Council of Governments (MWCOG) forums (e.g., meetings of the Management and Operations/ITS (M&O/ITS) Policy Task Force), in regional ITS collaboration groups such as the emergency management group, or were explicitly identified by the general public, media, or local jurisdictions. These needs indicate current stakeholder interests in deployment of specific systems, their desire for expansion of existing systems, and the need to investigate emerging technologies in the NOVA region. The needs provide specific indications regarding the systems and technologies desired in the region. This information provides insight into the areas within the Regional ITS Architecture important to stakeholders and the types of projects that could be considered for future deployment. These needs and issues expose areas that need to be addressed in order to facilitate interagency coordination for ITS deployment involving multiple stakeholders. The technical needs and institutional issues are detailed below.

3.1 Integrated Response and Coordination Especially During Regional Emergencies

Recent emergencies, including the terrorist attacks of September 11, 2001 and Hurricane Isabel in 2003, put transportation management and operations enhancements for emergency preparedness in the spotlight for the entire region. Though efforts were commendable on the part of involved agencies, a number of transportation problems ensued in part because there was no established regional means of coordination among all involved public safety, traffic, transit agencies, and decision-makers in a timely manner.[3]

The Metropolitan Washington Council of Governments adopted the Regional Emergency Coordination Plan (RECPSM) on September 11, 2002. The document was revised in March 2004 and sited several key recommendations about regional emergency management including:

- Carrying out regional emergency management coordination efforts on a continuing basis.
- Conducting a coordinated regional public education campaign on emergency preparedness.
- Ensuring that timely information is provided to the public during incidents.
- Strengthening emergency communications and coordination in the transportation sector.

[3] MWCOG, Options for Strengthening Regional Communications and Coordination in the Transportation Sector Staff Report to the National Capital Region Transportation Planning Board of April 14, 2004.

The region has identified and is addressing a need for the creation of a new Regional Transportation Communications and Coordination Organization. NOVA has been working with various regional partners towards the development of CapCOM – a regional coordination center to monitor regional transportation system conditions and be ready to initiate and facilitate the regional communications and coordination process in the transportation sector.

In addition to the new center, other needs include continuation of scenario-based workshops, safety and security training, and exercises or drills to test emergency response plans, modify existing plans, and test alertness levels of emergency response systems. A coordinated regional public education campaign on emergency preparedness is essential to educate the public on the different types of responses required. Timely, effective messages or instructions need to be distributed to people everywhere on what they need to know and actions to take during the emergency. Messages must be action-oriented, credible, consistent, timely, specific, and simple.

A need exists to develop procedures for the use of transit during emergencies and evacuations especially for HOV utilization, shoulder usage, suspension of tolls, communications between transit vehicles and field equipment, and communications from transit vehicles to traffic centers. A Northern Virginia Transit Operators Special Meeting on Emergency Coordination, Communications and Security[4] held in the aftermath of September 11th identified the need for improved communications between NOVA and transit agencies, including the need for unified notification between transit agencies as well as between transit agencies and NOVA.

3.2 Automated Inter-Jurisdictional Information Exchange Capabilities

Effective response to emergencies and traffic disruptions depends upon availability of systems and staff to monitor incident information, to share information among transportation and other agencies, and to assist in informing the public. This is especially true in a jurisdictionally-complex region such as NOVA. After the Partners in Motion experience, the Washington Metropolitan Region (referred to as *Washington D.C. Region* in the rest of the document) recognized the need to have a regional transportation data clearinghouse that can be used by ISPs to offer traveler information to the general public.

MWCOG has also considered the need for technical systems and database integration among the jurisdictions in the region with the goal that information entered by an operator in one center into an agency database can be automatically shared with other agencies' databases, and thereby to other necessary personnel and centers, with little or no further time-consuming action on the part of those personnel.

In response to these needs, the Washington D.C. Region has proposed RITIS, the Regional Integrated Transportation Information System. RITIS, which falls under the purview of

[4] Northern Virginia Transit Operators Special Meeting on Emergency Coordination, Communications and Security Meeting Summary, September 18, 2001.

CapCOM and is managed by the University of Maryland's Center for Advanced Transportation Technology (CATT) lab, is a software system that contains fused transportation-related data from a number of regional agencies and makes that data accessible to participating regional agencies. In simple terms, it can be thought of as a central, consolidated collection of regional transportation data. Currently, agencies from the Northern Virginia area, Maryland, and the District of Columbia are eagerly participating and helping RITIS become a reality.

Improved information exchange is also a key priority in the new transportation act (SAFETEA-LU) of 2005. The law requires the creation of a Real-Time System Management Information Program. Under this new program, the Secretary of Transportation will establish a real-time system management information program to provide, in all states, the capability to monitor, in real-time, the traffic and travel conditions of the major highways of the United States and to share that information to improve the security of the transportation system, address congestion problems, support improved response to weather events and surface transportation incidents, and facilitate national and regional highway traveler information. Data exchange formats, to be established by the Secretary of Transportation within two years, will ensure that data may readily be exchanged with state and local governments and the traveling public. States may use National Highway Safety (NHS), Surface Transportation Program (STP), and Congestion Mitigation and Air Quality (CMAQ) funds for planning and deployment of real-time monitoring elements. States will be able to use their state planning and research funds for planning of real-time monitoring elements.[5]

3.3 Improve Incident Detection Capability

A subset of the previously stated need is the need to improve incident detection and verification. A recent NOVA study[6] found that the NOVA is already utilizing many of the prevailing methods to detect incidents. However, the investigation does recommend enhancing some of the existing approaches in order to improve incident detection. The study recommended that NOVA continue its practice of obtaining information from police CAD systems as the primary incident detection source. In fact, this mechanism should be enhanced by:

1) Linking the STC software with all of the local and state police CAD systems so that incident reports are automatically entered into the STC software without manual re-entry.
2) Providing a mechanism for police CAD systems to become aware that NOVA has verified a reported incident through the use of CCTV cameras.
3) Providing a mechanism for police CAD systems to become aware of new incidents that the STC has detected.

[5] SAFETEA-LU Sections [1201, 5205].

[6] Virginia Department of Transportation, On-Call ITS / Safety / Operations Contract, 151-BLW, Task B.1.2: Incident Detection, Incident Detection Software Evaluation Memorandum, March 7, 2005.

4) Continuing and enhancing efforts to educate the public on how to best notify authorities of incidents.
5) Promote the deployment of technologies to accurately and automatically locate cell phones.
6) Ensuring that all high-priority areas are adequately covered with CCTV cameras.

The secondary source of information should be the Safety Service Patrol. In order to receive this information, communications will need to be improved between the SSP so that the STC immediately becomes aware of any incident which the SSP discovers. Further, combining this mechanism with the above improvements will also allow the state police to become aware of any incident discovered by the SSP. NOVA also currently monitors police scanners. This is a valuable and inexpensive tertiary source of information that should be continued.

Building upon the success of the NOVA – Virginia State Police (VSP) CAD integration, NOVA seeks an opportunity to "partner" with like-minded agencies in the region to leverage the information collected in order to provide a safe, reliable traveling experience in Northern Virginia. Partnering is already underway with Fairfax County adding specific NOVA requirements to their Request for Proposals for procuring a new CAD system. Other creative approaches include the use of transit buses as vehicle probes for incident detection. Meetings with transit agencies in NOVA revealed that drivers often come upon incidents on the road, which they report to their dispatch centers, and which could provide STC with another source of incident information.

3.4 Regional Traveler Information

NOVA is committed to making personal travel as safe and easy as possible. Existing regional and state-wide traveler information such as the state-wide 511 phone system and websites are valuable for pre-trip and en-route traffic conditions. There is a need to expand the coverage of the traveler information tools, including expanding the coverage of 511 to all U.S routes as well as adding some major state routes, including toll routes, and adding incident information from local jurisdictions. A need for a regional 511 system for the Metropolitan Washington area has also been expressed and studied.

3.5 Transit Signal Priority and Emergency Vehicle Pre-emption

Several local transit agencies have expressed the need to establish information exchange with the signal system for signal priority for schedule adherence and improving transit performance. These requests will either be center-to-center or field-to-field information exchanges for coordination across multiple intersections. The Washington D.C. Region has studied the impacts of implementing transit signal priority on US-1 in Fairfax and Columbia Pike in Arlington, two high-volume arterials in the NOVA region. Local jurisdictions such as Fairfax have expressed a need for Emergency Vehicle Pre-emption for police and fire vehicles to reduce incidence of emergency vehicle accidents and to reduce response times.

3.6 Enhance Coordinated Traffic Signal System

Traffic signals are one of the most commonly recognized symbols of traffic control by the general public. Resources spent on improving traffic signal systems can result in huge benefits. The well-publicized National Traffic Signal Report Card (National Transportation Operations Coalition, 2005) recognized that resource constraints prevent the use of traffic signals to their full potential. A coordinated signal system, like the one in NOVA, needs to:

- Frequently review traffic signal timing to ensure optimal performance.
- Continually evaluate the potential of, and implement as appropriate, the latest traffic signal technologies and strategies, such as adaptive signal control, where traffic signal timing is constantly and automatically adjusted by the signal controller to fit changing traffic conditions.
- Rapidly implement revisions to traffic signal timings.
- Concentrate on coordination across jurisdictions.
- Accommodate changes due to planned and unplanned changes in travel patterns.
- Respond quickly to customer complaints and maintenance requests.
- Plan for and phase upgrades to traffic signal hardware and software over time so as to ensure acceptable system performance and to spread out expenditures.

3.7 Better Use of Variable Message Signs (Travel Times, More Useful Messages for Congestion and Incident Management)

The Federal Highway Administration (FHWA) has unequivocally stated that better VMS information, based on travel times, can be displayed with the information currently available and there is no need to wait for more complete or "full" data coverage. A "dark" or blank VMS is a transportation investment that is not being fully utilized.

A key enhancement for the NOVA region is the display of travel times. NOVA needs to investigate and implement a travel time messaging display system. Travel time messages are not appropriate for every location, but they have proven successful in regions or corridors that experience periods of recurring congestion – congestion generally resulting from traffic demand exceeding available capacity and not caused by any specific event such as a traffic incident, road construction, or a lane closure. The VMS can provide dynamic travel time information instead of providing generic messages such as "congestion ahead" or "stay alert." Recent case studies conducted by FHWA have further underscored the need for travel times.[7] Other enhancements include better incident messages such as alternate routes, queue lengths, and expected delay times. Ultimately, there exists a strong need to better utilize an already useful transportation asset.

3.8 Expand STC Coverage and Capability to All NOVA Freeway Miles and Critical Arterial Corridors

Currently, the STC maintains and operates ITS equipment on interstates in NOVA. However, for a more corridor-based operations approach, it is essential that STC is aware of traffic conditions on adjoining or alternate arterials. Doing so will require that current functional and geographic coverage limitations with STC software be addressed. NOVA needs situational awareness along the arterials to direct traffic in cases of incidents and emergency evacuations. The current criteria that are used for selecting critical arterial corridors are:

- Evacuation route
- 511 coverage
- Safety corridor
- Forecast traffic
- National Highway System

3.9 Improve NOVA and Emergency Responder Field Coordination During Incidents

There exists a need to improve communications between field responders (i.e., the SSP and local police and fire vehicles) and the STC. A study for NOVA[8] revealed that SSP uses the CapWIN tools to create incident "chat rooms" for any incidents around the region that involve the SSP. SSP enters incident information into its own Incident Management System (stand-alone database in a laptop in the vehicle), but the data are not automatically sent to personnel at the STC. In order for the STC Traffic Operators to respond to an incident with messages on a VMS for example, the SSP patroller must call the STC Traffic Operators with the information about the

[7] FHWA, Travel Time Messaging on Dynamic Message Signs – Case Studies of Chicago, Nashville, Portland and Houston, 2005.

[8] Virginia Department of Transportation, On-Call ITS / Safety / Operations Contract, 151-BLW, Task 02: Northern Virginia Task Support, Subtask B.2 – Software (Sharing and Portal Integration) Technical Memorandum, DRAFT.

incident. SSP receives calls from surrounding law enforcement personnel because of the outstanding personal relationship the SSP supervisor has with many regional public safety personnel. Without this personal relationship, the SSP group might be delayed in discovering incidents or may never know about them. NOVA has tried to address this issue by conducting a series of interviews and recommending a series of quick fixes including sharing the same incident management database in real-time, cell phone with camera, AVL, and CCTV view at laptop in the SSP vehicles.[9] But in the long term, this also needs to be addressed.

While the above examples represent some level of integration and information sharing between the field and centers, it is rudimentary. A higher degree of sophistication is needed in order to ensure consistency and reliability and to ensure that the STC has the latest awareness of the status of incident response so they can provide travelers with updates and make operational adjustments.

3.10 Enhance Traffic Surveillance for Travel Time Measurements Using Probes, Toll Tags, and Cellular Technologies

Existing traffic coverage consists primarily of an extensive network of cameras and loop detectors. The cost of the installation and maintenance of an extensive detector network, especially loops, plus the now recognized limitations of such detectors in automatic incident detection, necessitates NOVA to look at alternate traffic surveillance technologies, as well as new business models such as public-private partnerships or out-sourcing. New technologies have to be non-intrusive and capable of providing travel time data. Promising approaches include toll tag readers, license plate readers, obtaining road condition information from private information service providers, and using cellular phones as probe devices.

3.11 Smart Parking Management and Information Systems

There is a need to provide better information on the status of the Park-n-Ride lots operated by NOVA as well as to share parking information with the local transit agencies such as the Washington Metropolitan Area Transit Authority (WMATA) and the Metropolitan Washington Airport Authority (MWAA). Currently no such capability exists. During the Springfield Interchange construction project, the NOVA planning staff proposed to manage the Park-n-Ride parking lot facilities more efficiently. A smart parking management and information system could have addressed that need but was not implemented due to lack of funding. The Dulles Rail planning phase also documented this need.[10]

[9] Virginia Department of Transportation, STC Software/Operation Assessment: Quick-Fix Recommendation, By STC Software/Operation Assessment Team, October 29, 2004.

[10] Virginia Department of Rail and Public Transportation Virginia Department of Rail and Public Transportation, Dulles Corridor Rapid Transit Project, Technology Implementation Plan, Dulles Corridor Task Force, PB Farradyne, December 30, 1999.

3.12 Approach to ITS Research and Planning

NOVA desires coordination with planning and traffic engineering groups, both locally in NOVA as well as state-wide, to maximize the use of traffic data collection infrastructure. Planning and traffic engineering groups require traffic data with different aggregation levels (days instead of hours), higher quality (missing data is unacceptable), and vehicle classification information (not a priority for systems operations). Such differences often lead to both groups having different traffic detectors at the same location. While the use of data from ITS detectors is not as straight-forward as it seems, it is a valuable resource that needs to be exploited to increase the coverage for planning and traffic engineering applications.

3.13 Regional Telecommunications

Telecommunications is at the core of ITS. Without telecommunications, field data cannot be sent to the STC for processing. A fiber-optic network is needed to provide the capacity for the data and video that is necessary to improve operations. A study in 2000 by P.B. Farradyne (PBF)[11] also indicated the need to connect the region's existing fiber infrastructure.

Ongoing tasks to assess the adequacy of the communications infrastructure have also highlighted this area as a critical need.[12] Several immediate priorities were identified for the communications infrastructure. The first priority is to improve the reliability of the fiber-optic network supporting mission-critical ITS elements for STC operations. The second priority is to identify techniques and technologies for upgrading/replacing existing communication equipment that is approaching obsolescence with limited availability of spare parts. The third priority is to determine an effective video distribution strategy that accommodates an evolution towards digitally-compressed video, supports existing State-wide Video Distribution initiatives, can more readily adapt to a relocated Northern Virginia STC and co-located PSTOC, and reduces dependence on the existing video switch equipment, which is also approaching end-of-useful life.

It was recommended that a mixture of fiber-optics, wireless, and leased lines be employed to create the multi-technology network. It is also recommended that NOVA place first priority on utilizing existing and new fiber-optic cabling infrastructure for providing capacity, flexibility, scalability, fault-tolerance, and a high degree of security. Fault-tolerant technologies such as Virtual Router Redundancy Protocol (VRRP) and/or WDM/SONET should be employed. Diversified paths (e.g., physical rings) are also a recommended fault-tolerant distribution topology that should be used, particularly for backbone design and implementation.

[11] COG Report by PBF.

[12] Virginia Department of Transportation, On-Call ITS / Safety / Operations Contract, 151-BLW, Task 02: Northern Virginia Task Support, Subtask B.4 – Communications.

3.14 Improving Existing GIS for Asset Management

NOVA has used Geographic Information Systems (GIS) technology and has been very effective in creating and organizing a comprehensive ITS asset inventory.[13] However, due to the very dynamic nature of ITS and the communications industry, the GIS needs to be maintained and continuously updated to make it even more useful than the initial inventory and analysis effort. NOVA needs to maintain consistency and compatibility among technology systems implemented locally and with state-wide systems.

3.15 Quicker Dissemination of Traveler Information

NOVA received customer comments, specifically in 2002, that VMS messages are not very useful for drivers already in, or approaching, congestion. NOVA has recognized the need to act quickly on customer complaints especially those pertaining to information needs. Travelers frequently complain that VMS signs do not have information about an incident or congestion that they are currently experiencing. A PBF study[14] in January 2004 indicated that with existing incident detection, verification, and response, travelers would not see the full benefits of ITS for incidents which are cleared within 43 minutes. The study recommended that NOVA strive towards providing incident information to travelers within five minutes of incident verification.

In addition to improving the speed in which incident information is collected, verified, and relayed to travelers, NOVA will monitor the potential of various emerging technologies and techniques to facilitate traveler information activities. In the long-term, permanent, fixed roadside information dissemination media such as VMS may be replaced or augmented by approaches whereby information is communicated electronically directly into vehicles and presented to drivers as visual or audio displays. Such approaches are included within the area referred to as Vehicle Infrastructure Integration (VII), which is one of nine Federal Highway Administration ITS Initiatives and an area that NOVA will monitor.

3.16 Maintenance and Upgrade of Field Equipment

The problems with field equipment severely hamper performance. A PBF study[15] in January 2004 indicated that the average field equipment availability in October 2003 ranged from just 3% for inductive loops to 65% for ramp meter systems. Important field equipment like VMS (20%) and CCTV (15%) also had low availabilities. Maintenance and upgrade of these field devices is essential not only for improving operations but also to improve and maintain customer satisfaction. Rapid response to customer complaints about signs, traffic signals, and other equipment is an essential need for NOVA.

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[13] Virginia Department of Transportation, ITS/GIS ASSET BASELINE 1.0, May 2002, available at http://www.vdot-itsarch.com/nova/docs/gis.pdf.

[14] Virginia Department of Transportation, NOVA ITS Program Performance Measures, PB Farradyne, 2004.

[15] Virginia Department of Transportation, NOVA ITS Program Performance Measures, PB Farradyne, 2004.

3.17 Weather Information Collection and Dissemination

Weather management is one of NOVA's key areas of responsibility with at least three major spheres of activities:

1) Advisory strategies provide information on prevailing and predicted conditions to both transportation managers and motorists.
2) Control strategies alter the state of roadway devices to permit or restrict traffic flow and regulate roadway capacity.
3) Treatment strategies supply resources to roads to minimize or eliminate weather impacts.

Providing accurate weather management data is essential in the region. Information on weather conditions, snow removal, and roadway driving conditions is of great value to the region. While several sources exist for weather information for travelers planning a trip, there is a need to provide an en-route traveler with information on their upcoming conditions through dissemination mechanisms such as highway advisory radios, 511, and other portable electronic devices. Weather information is also a national-level focus with FHWA launching the CLARUS initiative which strives to create a one-stop weather information center for the nation.

3.18 Freight Coordination

Coordination with freight management in the region is becoming critical to NOVA as it expands ITS infrastructure to I-81, which is an important freight corridor. Several truck-trailer crashes have repeatedly driven home the point to NOVA that truck safety and security are also especially important to because of incident impacts. Hazardous materials (hazmat) transportation through the area is also a concern, with a need for more information exchange between freight carriers, Departments of Motor Vehicles (DMVs), state freight management systems, and traffic management.

One of the areas in which improved coordination between NOVA traffic management and agencies charged with regulating freight operations will be considered is the area of commercial vehicle credentialing and enforcement (weights and safety requirements). The Federal Motor Carrier Safety Administration (FMCSA) Commercial Vehicle Information Systems and Networks (CVISN) Program is a focal point for activity in this area. CVISN activities carried out at the state level include electronic truck safety and weight screening, safety information exchange (via the national SafetyNet data exchange network), and electronic credentialing. Virginia has been active in CVISN. In so much as many CVISN activities include a roadway component, coordination between NOVA traffic management and state CVISN and other freight activities is important.

3.19 Improved Access for Pedestrians and Special Needs

With NOVA's rapid urbanization, NOVA is keenly aware of the need to improve pedestrian facilities along major corridors which no longer serve as suburban streets. NOVA needs to revisit the adequacy of pedestrian facilities in the region. Requirements range from retrofitting sidewalks to using technology to improve access for pedestrians.

4 NOVA SMART TRAVEL GOALS AND OBJECTIVES

Realization of the NOVA Smart Travel Vision described in Section 3.0 will require accomplishment of a number of specific goals and their associated objectives. Under each objective, several strategies are identified that will be carried out in order to accomplish the objective. Development of the goals and objectives presented here included a review of goals and objectives identified by the various NOVA sections and those presented in regional and state-wide transportation plans.

The four NOVA Smart Travel goals are:

1) Enhance public safety
2) Enhance mobility
3) Make the transportation system user-friendly
4) Enable cross-cutting activities to support goals 1-3

The objectives and strategies associated with each of these goals are shown in Table 4-1.

Table 4-1. NOVA Smart Travel Program Goals, Objectives, and Strategies

Objectives	Strategies
Goal 1: Enhance Public Safety	
1.A – Minimize Incidents	• Reduce crashes on freeways and surface streets: NOVA will implement safety improvement projects that promote a higher quality of life for the residents and visitors of Virginia. • Integrate with "sources" of incident information, such as CAD systems, to speed incident detection and response (CAD Integration). • Minimize and manage impacts to safety and mobility in construction and maintenance work zones.
1.B – Respond Efficiently to Incidents	• Maintain a robust SSP Program. • Improve and expand detection capability through new technologies, partnerships, and improvements to existing systems. • Coordinate and cooperate across jurisdictional and agency lines using technology and best practices.
1.C – Improve Transportation Security	• Protect critical infrastructure in the NOVA region such as bridges and choke points. • Efficiently communicate and cooperate with local and regional jurisdictions regarding critical incidents and evacuation routing, especially those incidents regarding the National Capitol Region. • Efficiently share accurate and timely travel condition, roadway closure, routing, and other information with the public during emergency transportation operations. • Effectively manage evacuating traffic travel through the NOVA roadway network during emergency transportation operations using contra flow, suspension of tolls, transit etc.
Goal 2: Enhance Mobility	
2.A – Operate the Transportation System Effectively and Efficiently	• Improve communication and coordination of agency activities: NOVA will share information on and coordinate with planned and on-going activities within the agency and with other agencies. • Maximize the use of the transportation system capacity to move traffic. Detailed traffic and roadway conditions data are vital for NOVA to assess the performance of the roadway network and allow them to be more proactive in managing the roadways for the public. • Improve and maintain traffic flow on surface streets: Develop a balanced signal system operation approach that is time, event and conditions-sensitive. • Proactively monitor and assess the condition of the freeway, primary, and secondary road system in real-time regarding: safety, congestion, travel information, incident detection/response, traffic volume, speed, and capacity. • Follow the NOVA operations business process model to effectively integrate traditional traffic engineering and emerging ITS solutions to produce "quick implement" projects that deliver immediate or near-term results. • Improve the process for outcome-based project planning and implementation: Measurement of project development will help NOVA gauge the deployment of its programs and track the successful operation of systems. This information can be used to replicate NOVA successes elsewhere in Virginia. • Timely mobilize/demobilize and improve overall efficiency of snow operations. • Effectively identify hot spots and develop tactical and operational adjustments to improve service delivery and efficiency.

Table 4-1. NOVA Smart Travel Program Goals, Objectives, and Strategies (Continued)

Objectives	Strategies
2.B – Enhance District Operations and Maximize the Effectiveness and Efficiency of Personnel, Equipment and Resources	• Improve intra-agency cooperation by implementing the NOVA Operations Business Process Model: The complex operations of the NOVA District require close coordination among the offices within NOVA. Information sharing is crucial for maintaining the coordinated operation of disparate work groups. • Improve inter-agency cooperation: NOVA is a public organization with a significant influence on the operation of local and other state agencies. NOVA will support the mechanisms through which they and other agencies share information. • Improve efficiency in tracking of resources: The enormous inventory that NOVA works with must be effectively managed so that resources can be shared when needed, requisitions can be filed based on need, and the maintenance of all NOVA resources can be tracked. • Utilize performance-oriented standards for system and field device operations wherever feasible, e.g., VMS are operable at least X% of the time. • Ensure that ITS projects are implemented on time and on budget.
2.C – Expand ITS Infrastructure to Enable Corridor Management	• Implement coordinated, corridor-level traffic management on key freeway segments and adjacent arterial streets. • Ensure that a robust inspection and maintenance program is in place that is results-based and focused on condition assessment and operability of a variety of ITS systems and devices, including telecommunications. Special emphasis will be placed on system compatibility, life cycle, and achieving tangible results. • Expand the geographic coverage of ITS infrastructure on the NOVA arterial and freeway transportation system, including but not limited to ITS and traffic signal systems, freeway lighting system, CCTV system, variable message boards, incident detection system, condition monitoring system, vehicle classification system, ramp-metering system, gate control system, lane control system, and others.
Goal 3: Make the Transportation System User Friendly	
3.A – Enhance and Simplify NOVA Interactions with Travelers	• Improve customer service: NOVA will ensure that travelers receive the services they request promptly and to their satisfaction. NOVA will strive to decrease the amount of time it takes to respond to citizens inquires. • Simplify payment for transportation services: NOVA will support a common payment system for transportation services, so that it is easier for customers who use various modes of transportation.

Table 4-1. NOVA Smart Travel Program Goals, Objectives, and Strategies (Continued)

Objectives	Strategies
3.B – Support Traveler Information Services	• Improve roadway network information dissemination: Provide information to travelers via appropriate media with the right message to the right audience. In many instances, private enterprise will be more capable of packaging information that the public will desire. NOVA shall leverage cooperation opportunities with the private sector to ensure that customers get the best quality and timely traffic information. • Effectively provide data and facilitate multi-modal real-time traffic information for the public so that travelers may select the most effective mode, route and travel time choices. • Support comprehensive traveler information services by coordinating with other agencies in disseminating parking, tourism, and transit information. • In cooperation with other agencies, increase the speed with which incidents are identified and communicated to travelers so that travelers can modify their travel plans as appropriate.
Goal 4: Enable Cross-Cutting Activities to Support Goals 1-3	
4.A – Enhance Mobility Using Technology	• Reduce travel time and improve schedule reliability for buses and HOV carpool and vanpool users: NOVA supports the use of multi-occupancy vehicles and will maximize operations of HOV and general purpose lane facilities. • Reduce demand on the roadway network, primarily during peak hours: NOVA will work toward promoting other modes of travel and spreading demand so that the use of single occupancy vehicles is reduced, and peak congestion is reduced. • Improve pedestrian and special needs accessibility along major arterials by retrofitting pedestrian facilities in rapidly urbanizing areas.
4.B – Create a 21st Century Foundation for Operations	• Integrated ITS Deployment – Facilitate integrated and systems engineering-based ITS and Transportation Management in the NOVA and Washington Metropolitan Region so as to minimize “after thought” ITS investments. • Knowledge building – Bridge the ITS Program Teams’ knowledge and skill gap in order to improve performance and deliver the program effectively, to leverage investment from the academic and private sectors in order to improve ITS program performance. • Project Identification – Develop, maintain, and assess an ITS and traffic engineering project pool to identify candidate projects that contribute to safe and efficient traffic flow. Determine work plan and funding requirements/sources including earmarks, CMAQ, SPR, soSYP, and iSYP. • Mainstreaming of ITS – Relying less upon Federal ITS earmark funding, ensure that ITS projects are considered as part of regular planning processes and incorporated appropriately into traditional construction and maintenance projects.
4.C – Conduct a Strategic Research and Development Program	• Continue to track USDOT ITS program direction, including the nine ITS initiatives, and reflect in the NOVA ITS program as appropriate (e.g., consider field operational test funding opportunities). • Coordinate with local research universities and research institutions to develop new, beneficial technologies and technology applications. • Strategize research priorities and initiatives based on NOVA local needs as well as VDOT statewide and industry direction.

5 ITS SYSTEMS

This section provides an overview of the existing ITS systems in the NOVA region. The systems inventory presented here focuses on major systems, categorized by the functions they perform. The inventory is important in establishing a context for the regional ITS operating concept presented in Section 6.0.

5.1 Overview

The NOVA District encompasses a small but heavily populated area that has seen significant ITS investment over the past few years. The NOVA systems and subsystems interact closely with other jurisdictions and states (DC and Maryland) that have also made significant ITS investments. Due to the abundance of ITS systems and the interactions between NOVA and the regional and state-wide system, the inventory discussed in the sections below has been categorized based on the geographic boundaries of where the systems are operated (i.e., NOVA, State-wide, Regional). The inventory presented here focuses on NOVA systems and the regional and state-wide systems that currently interact or have planned interactions with NOVA systems.

5.2 NOVA Geographic Region

NOVA is comprised of NOVA-owned and operated facilities located within the jurisdictions of Arlington, Fairfax, Loudoun, and Prince William Counties; the Cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park; and the Towns of Herndon, Clifton, Dumfries, Middleburg, Leesburg and Purc. The NOVA region is shown in Figure 5-1. The major roadways that are included in the region include:

- Interstate 66 (I-66) from DC to State Route 234
- Interstate 395/95 (I-395/I-95) from DC to Route 34
- Dulles Toll Road (DTR)
- All of I-495 within Virginia

NOVA maintains the freeways and primary roadways and operates traffic signals throughout Fairfax, Loudoun, and Prince William Counties. Many jurisdictions located within NOVA boundaries are responsible for operating and maintaining the secondary roadways and providing emergency services within their borders.

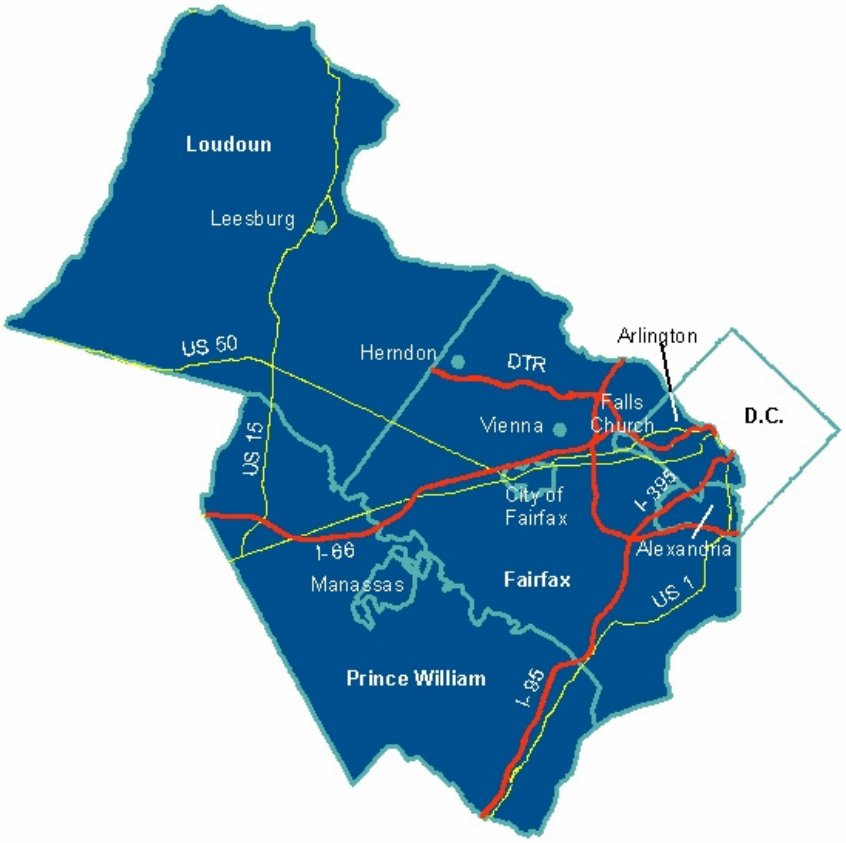

Figure 5-1. NOVA Geographic Boundary

NOVA interacts significantly with agencies in the District of Columbia and Maryland for traffic management and incident management. Several Washington Metropolitan regional transportation operations collaborations exist to tackle some of the most congested roadway sections in the country. Additionally, numerous Federal, state, and local transportation stakeholders, including transit, police, emergency, medical, and other agencies, play a role in operating and managing the roadways and other regional transportation systems. Recently, there has been a push within the Washington D.C. Region to strive towards regional coordination and interoperability. Several initiatives like CapCOM and National Capital Region Interoperability Program (NCRIP) are underway.

5.3 Systems Inventory

The existing NOVA systems inventory is categorized into the following major subsystems:

- Freeway Management and Operations
- Incident and Emergency Management
- Surface Street and Arterial Management
- Traveler Information
- Archived Data Management and Planning Functions
- Electronic Payment

In addition, several regional and state-wide systems with which NOVA systems coordinate are also highlighted.

5.3.1 NOVA Systems

Freeway Management and Operations

NOVA's Freeway Management System became operational in 1985 and is located in the Smart Traffic Center. The NOVA STC is the nerve center of an integrated system of advanced technologies including computer software, traffic cameras, lane control strategies, ramp meters, reversible control gates, and HOV lane controls.

Concurrent with the development of this Program Plan, a series of studies have been conducted documenting a number of deficiencies associated with the STC software systems, including operating systems and specific applications utilized to control field devices. Studies have also been conducted examining the ITS field infrastructure needs in the NOVA District. As a result of these studies, a wide range of recommendations have been identified to upgrade capabilities and expand systems. Many of these recommendations will greatly enhance the ability to carry out the freeway management and operations activities summarized in the remainder of this section.

From the STC, NOVA monitors and manages traffic, recognizes and responds to incidents, and delivers traveler information to motorists. STC operates and controls traffic monitoring and traffic management field devices that are typically located along the roadside. In addition, STC operators constantly communicate with the Safety Service Patrols in clearing and managing incidents. STC and SSP will soon be able to share incident data in real-time via the same database. In addition, STC will soon be able to view SSP locations in order to dispatch patrollers to incident scenes more efficiently. SSP is equipped to take a snap shot of incidents using cell phones when needed and share this information with the STC operators. They can also view, in their vehicles, any CCTV cameras that STC operates.

The STC also coordinates with other agencies for responding to incidents and emergencies and participates in a regional incident management plan. STC is currently leading the contract for

sharing CCTV images with public safety and other transportation management centers in the Washington DC region. Other functions of the STC include:

- Support of the Department of Environmental Quality in roadside emission testing.
- Support traffic data sharing with those agencies that promote ride sharing and parking management.
- Support testing and evaluation of new systems and concepts for improved operations and management in conjunction with the University of Virginia Smart Travel Lab (STL).
- Integrate with existing and planned regional systems (e.g., MD, VA, WMATA, etc.).
- Coordinate with other VDOT Districts (Fredericksburg, Culpepper, Richmond, and Staunton) and the state-wide Transportation Emergency Operations Center (TEOC).

The STC will be co-located in the Public Safety & Transportation Operation Center in November 2007, along with Fairfax County and Virginia State Police.

Table 5-1 provides a brief description of the devices operated by the STC, including variable message signs, closed-circuit television cameras, etc.

Table 5-1. NOVA Traffic Management Field Devices

Closed-circuit Television Cameras: The STC traffic management system includes 123 CCTV cameras. Most of the cameras were installed by 1997 or later, however, several on the Woodrow Wilson Bridge and Interstates 395 and 66 were installed as early as 1988. All cameras are color, with pan, tilt, and zoom capabilities. Video feeds from the cameras are transmitted via a distribution and trunk communications network. In addition to the NOVA-owned cameras, the STC has the ability to interface with (view only) approximately 50 cameras operated by the Maryland State Highway Administration CHART System. Cameras are used for traffic management purposes only. Specifically, cameras are used by STC Operators to detect and verify incidents. While camera views are generally made available to the public through agreements with privately held media interests, some incident views are not shared by NOVA with the media due to their graphic nature.

Condition Monitoring and Incident Detection Systems (CMS and IDS): The condition monitoring and incident detection systems include 165 incident detection stations and approximately 1,700-1,800 inductive loop detectors. The system also includes 12 acoustic detectors and 18 radar detectors. Typically, detector stations are spaced approximately every 2,000 feet on the Northern Virginia interstates and on selected on-ramps. Loop detector pairs are spaced approximately 12 feet apart on mainlines. The loop detectors are operated using "Type 170" controllers. Condition monitoring and incident detection systems are used to provide automated indications of disturbances to traffic flow.

Vehicle Classification System (VCS): The Vehicle Classification System (VCS) includes 23 stations located along Interstates 66 and 95. Vehicle classification data is collected using piezo electric detectors. Piezo detectors are metal strips placed on or near the road surface to measure the degree of electric polarization each time a vehicle wheel rolls over them. This allows for the reporting of vehicle wheelbase and axle count data. FHWA reports that vehicle classification data are commonly used by agencies to monitor truck volumes and freight movements. Typically, DOTs are also required by regulation to provide FHWA with vehicle classification data on an annual basis. The STC collects and sends VCS data via FTP to six organizations. These data are sent every 60 seconds and stored and archived for future use as needed.

Gate Control System (GCS): The GCS is composed of 25 gate groups and 175 gate arms on I-66 and I-395/95. The purpose of these gates is to provide physical control and management of access to the HOV lanes. Reversible lanes inherently have the potential for wrong-way drivers. The GCS is one feature of the overall system used by NOVA to achieve safe HOV operations.

Table 5-1. NOVA Traffic Management Field Devices (Continued)

Lane Control System (LCS): The Lane Control System consists of 29 signals and is used to provide additional capacity on the shoulders of I-66 during peak periods. A green arrow is displayed to indicate that the shoulder is open, while a red x is displayed to indicate that the shoulder is closed. The signals are operated with 170 controllers. The LCS is used to open the shoulders to traffic during peak periods in the peak direction. Prior to activation, the Safety Service Patrol personnel drive the corridor, performing a visual "sweep", to ensure that the shoulder lanes are clear of any potential obstructions or hazards. The LCS can be used to open the shoulders to traffic upstream of an incident as well to reduce the potential for negative impact on mobility. Each sign may be turned on individually to provide a gradual transition. The LCS is not currently operated in conjunction with VMS, although most can be seen with CCTV cameras.

Ramp Metering System (RMS): The Ramp Metering System includes 26 ramps inside the beltway on I-66, I-95, and I-395 and involves application of control devices (signals and signs) by NOVA to regulate the number of vehicles entering freeways to keep flow on the freeways stable, thereby minimizing slowing and congestion. The system operates by alternating display of green and red traffic signals to motorists on the on-ramps, thus "metering" flow and minimizing shock waves to the mainline. Ramp meters are activated during peak periods in the peak direction. On I-395/95 on-ramps, northbound traffic is metered during the morning peak period from 6:00 a.m. to 9:00 a.m. and southbound traffic is metered during the afternoon peak period from 3:00 p.m. to 6:00 p.m. On I-66 on-ramps, eastbound traffic is metered during the morning peak period from 6:00 a.m. to 10:00 a.m. and westbound traffic metered during the afternoon peak period from 3:00 p.m. to 7:30 p.m.

Truck Rollover System: The truck rollover system is used to deliver a "Sharp Curve – Slow Down" message to truck drivers at two locations on I-495. The system monitors the height and speed of oncoming trucks (using acoustic detectors) and determines if the vehicle is approaching at an unsafe speed. If so, it will alert the truck driver with flashing lights and a sign message.

Incident and Emergency Management

The incident management system is highly integrated with the freeway management system. The Smart Traffic Center provides all dispatching, two-way radio capability, and highway advisory radio operation.

Current incident detection approaches includes monitoring of Virginia State Police CAD, Safety Service Patrol detection in the field (communicated via laptop data entry and phone calls), monitoring police radio, and information provided by the media. NOVA is actively researching system integration with VSP CAD, Fairfax County and other local agency CAD systems to improve incident detection. CCTV cameras are used to verify incidents and incident information is communicated to appropriate response agencies. The region has established protocols used by response agencies to secure the incident scene, manage traffic around the scene, and clear the incident to restore traffic flow.

A majority of the incident and emergency management functions are performed by NOVA STC. In addition to the STC, the SSP assists and performs emergency functions. The SSP is responsible for identifying and responding to incidents that occur on the NOVA roadway system. Safety Service Patrol receives emergency notification from customers through cellular telephone. The SSP also identifies incident locations, monitors the impact of incidents, verifies incidents, and shares incident information with STC and other agencies, along with removing or assisting

in removing obstructions from the incident scene. The incident information sharing responsibility mainly resides with STC, however, SSP does share information with other agencies' field personnel (e.g., police and other DOT's patrollers) via CapWIN and phone calls. Incident management is also a major function of the VSP, which is responsible for providing public safety in the state of Virginia, including responding to incidents that occur on the NOVA roadway system.

Surface Street and Arterial Management

The NOVA Smart Traffic Signal System is used for surface street and arterial management functions in the NOVA area. NOVA installs, monitors, controls and maintains over 1,000 traffic signals in the three counties: Fairfax, Loudoun, and Prince William. NOVA is able to manage traffic flow continuously, monitor the real-time signal status, collect traffic flow information, and adjust signal timing from a centralized traffic signal control system. The STSS includes roughly 1,200 intersections that NOVA maintains and operates and the number continues to increase. The STSS main server is headquartered at Camp 30, near exit 55 on Interstate 66. The system is operated using the MIST software, which is capable of monitoring signal status and collecting traffic flow data. Using MIST, NOVA staff can manage the flow of traffic by making remote adjustments to signal timings within the system. This, in turn, theoretically provides for minimum delay to motorists. STSS also includes field devices, which are typically located along the roadside and are controlled by operators, which aid in monitoring and managing conditions. Examples include traffic controllers for the traffic signal system, CCTV, and vehicle detection.

Traveler Information

The NOVA area provides traveler information to the public through various dissemination media including 511, VMS, highway advisory radio (HAR) and private media sources. Apart from that, NOVA also operates a customer service center that travelers can call for additional travel-related emergencies. A description of these traveler information services is provided below:

NOVA CSC (703-383-VDOT)

The NOVA Customer Service Center (CSC) is responsible for providing transportation administration and business information to the public. The Center provides "one-stop shopping" for all inquiries. During snow emergencies, the Center provides road reports, manages snow and ice control activities, and communicates with the regional Council of Governments, the Fairfax County School District, fire and police agencies. The CSC functions include:

- Monitoring roadways during inclement weather.
- Maintaining contact with media during emergencies with Public Affairs support.
- Disseminating construction, maintenance, and permit work schedules.
- Coordinating emergency response using all appropriate agencies.
- Receiving motorist emergency notification call information from other agencies.

Variable Message Signs

There are 206 variable message signs maintained and operated by the STC. These various sign makes and models include flip disc, light emitting diode (LED), and LED matrix display types. Most of the units are mounted overhead, however, some of the signs on Interstates 66 and 95 are mounted on the side of the road. VMS units are used by NOVA for the following purposes:

- Inform motorists of varying traffic, roadway, and environmental conditions.
- Provide specific information as to location and delays associated with incidents (including vehicles on shoulder).
- Suggest use of alternative routes to avoid incidents.
- Control and operation of HOV lanes.
- Display Amber Alerts, in conjunction with HAR, to disseminate information.

Highway Advisory Radio System

The highway advisory radio system is used to provide confirmed incident, roadwork, and congestion information to travelers. The current NOVA HAR system includes five transmitters and seven beacon signs. The number is increasing due to the addition from the Woodrow Wilson Bridge construction project's investment. When operating the HAR system, it is to be programmed within 5 minutes after confirmation of an incident. HAR is still used even when a limited number of signs in the area of the incident are present to instruct motorists to use HAR.

Internet

The VDOT state-wide travel center website provides information on weather-, maintenance-, and construction-related activities including lane closures on state roadways. This site can be accessed from the VDOT website (http://www.virginiadot.org/comtravel/eoc/NoVa.asp).

Real-time Traffic Images

NOVA aims to disseminate the data and video imagery from its STC software as widely as possible in order to:

- Reduce crashes and otherwise improve the safety of the surface transportation system.
- Inform the public and enhance the quality of transportation services.
- Facilitate route and mode choice among transportation system users.
- Foster the development of traveler services information by the private sector.

NOVA works with a private entity – TrafficLand – to create real-time traffic maps of CCTV images based on feeds from state agencies. This site can be accessed from the following website: (http://www.trafficland.com/findacam/trafficvideo.php?uid=0&map=100).

Since NOVA's partnership with TrafficLand, the video camera website has expanded to include other parts of Virginia, the District of Columbia, and Maryland. This provides customers a one-stop shopping for viewing traffic condition.

511 Virginia Website (www.511va.org)

The 511 Virginia website is an extension of the 511 Virginia phone service. The website provides real-time traffic, incident, weather, and maintenance and construction information. The website also provides capabilities for trip planning, tourist and traveler service location information, and links to transit services.

511 Virginia Telephone System

511 Virginia provides travelers information on Virginia's interstate system via telephone. Data available via the 511 phone system includes reported incidents, work zone locations, special events, and adverse weather conditions. Today, customers in Northern Virginia can access traffic information on I-66, I-395/I-95, I-495, and Dulles Toll Road. This system will expand over time and more roadways and services will be added as additional data from other sources become available, allowing 511 Virginia to provide comprehensive travel information on all major roadways.

Inspection, Maintenance, and Construction

NOVA has recently created a separate group dedicated to maintenance, installation, inspection, and construction of ITS field equipment including VMS, CCTV, HARs, and traffic detection equipment. They provide routine preventative maintenance and repair as needed. STC operators provide real-time data entry to the system in notifying the maintenance crew of failed equipment. Maintenance staff also provides equipment repair statistics to the newly created System Engineering group for further analysis on the technology that is used and the equipment life cycle. These activities will be supplemental to the activities carried out by the traditional maintenance and construction groups within NOVA.

NOVA Maintenance and Construction is responsible for various routine maintenance and construction activity on NOVA roadways, with some of these activities relating to NOVA Operations:

- Perform snow removal operations.
- Receive maintenance request from the Customer Service Center and STC.
- Provide the capability to identify the location of maintenance vehicles in real-time.
- Provide data on emergency and non-emergency repair needs to the appropriate VDOT agencies.

5.3.2 State-wide Systems

As discussed earlier, NOVA systems interact with several state-wide systems to perform and coordinate various functions including traveler information, emergency management, maintenance and construction management, and planning functions. These major systems are described below.

Virginia Operations Information System

The Virginia Operations Information System (VOIS) is a statewide database used for tracking incidents and facilitating transportation operations on major roads. Various agencies input incident, traffic, and maintenance data into the system. VOIS data also feeds the state-wide 511 service. VOIS is a separate system from the STC operator workstations and therefore STC operators must enter information twice. VDOT is planning to integrate all STC traffic management software with VOIS to address this problem.

For the 511 system, the Virginia Tech Transportation Institute (VTTI) takes the data that NOVA STC enters into VOIS and uses it to develop 511 advisories. The STC operator that monitors VOIS also serves as a point of contact with VTTI for the 511 system. Any incidents that are reported are confirmed with the district involved to ensure accuracy.

Transportation Emergency Operations Center

VDOT also operates a Transportation Emergency Operations Center in the Richmond Central Office to respond to wide-scale incidents and regional or state-wide emergencies. The TEOC also coordinates with NOVA STC, other state-wide TMC's, and regional emergency and incident agencies during major planned and unplanned events.

Archived Data Management System (ADMS)

The NOVA STC, SSP, and STSS share data with the University STL. STL archives the data and performs archived data management for VDOT. STL has created an archive data analysis tool called the Archived Data Management System (ADMS) aimed at not only the operation staff but also traffic engineers, transportation planners, and system engineers for their analysis needs. The ADMS system will be maintained and operated by VDOT Central Office.

The STL is a state-of-the-art facility that supports ITS research and education. Using the latest information technologies and analysis and modeling techniques, researchers in the lab are developing prototype systems and applications that promise to improve the effectiveness of ITS. The STL is a joint effort between the Department of Civil Engineering at the University of Virginia and the Virginia Transportation Research Council. The distinguishing characteristic of the lab is the direct connection established between the lab and transportation management systems operated by the VDOT. This connection provides researchers with direct access to real ITS data and systems. This direct access has allowed the lab to provide substantive contributions to the statewide VDOT Smart Travel Program.

Electronic Payment

The VDOT Electronic Toll Payment system, known as Smart Tag, is available for paying tolls at various toll facilities in Virginia. The Smart Tag Center funded by VDOT provides customer service to VDOT customers. VDOT Central Office administers Smart Tag and supports the following functions:

- Implementation of a toll tag that is usable throughout the state and within the I-95 Corridor Coalition states.
- Implementation of simplified payment media that can be used across transportation modes (i.e., tolls, transit, parking, etc.).
- Collection of toll revenues from collection of automated payment and distribute fees to participating agencies.
- Operation of regional electronic payment.

In 2004, the Smart Tag electronic toll collection system was modified to accept E-ZPass tags which are widely used along the East Coast. The Smart Tag/E-ZPass can be used on all toll roads with specially marked "Smart Tag" or "E-ZPass" lanes. This currently includes roads in Virginia, West Virginia, Maryland, Delaware, Pennsylvania, New Hampshire, New Jersey, New York, Maine, Massachusetts, and Illinois.

In the NOVA region, the Dulles Toll Road has operated an electronic toll collection system since April 1996. Dulles Toll Road Administration staff also perform traffic management functions and are responsible for identification and notification of incidents on DTR to the STC and SSP patrols as well in assisting incident clearance and traffic management.

Another toll facility in the NOVA region is the Dulles Greenway, a privately owned 14-mile toll road that connects Washington Dulles International Airport with Leesburg, Virginia. The Greenway also utilizes the Smart Tag/E-ZPass System. The Dulles Greenway Center is responsible for operations and provides incident and traffic information to the STC.

5.3.3 Regional Systems

Apart from the interactions between the state-wide systems, NOVA systems also interact closely with regional systems in the DC and Maryland area to provide NOVA region travelers with a complete picture of the Washington D.C. Region and to facilitate safe and efficient travel. The major systems that NOVA interacts with in the region are summarized below.

Coordinated Highway Action Response Team (CHART) System

CHART is Maryland's advanced traffic management system. In addition to the Baltimore-Washington Corridor, CHART includes state-wide traffic management services. The program is directed by the CHART Board, consisting of officials from relevant state agencies and is administered at the State-wide Operations Center (SOC), which functions on a 24/7 basis with

satellite Traffic Operations Centers (TOCs) across the state to handle peak-period traffic. The STC currently has the ability to view video and maneuver feeds from approximately 50 CCTV cameras that are operated by the Maryland State Highway Administration as part of the CHART system. Video feeds are viewed using a dedicated CHART workstation located in the NOVA STC control room. STC operators can also view CHART CCTV from the TrafficLand portal. STC operators primarily use these cameras to monitor interstate segments where traffic passes between Maryland and Virginia. STC also works with CHART operators in managing regional incidents and requesting messages to post onto each other's VMS signs.

CapCOM and Regional Integrated Transportation Information System

On March 16, 2005, U.S. Congressman Jim Moran announced at the Transportation Planning Board (TPB) meeting that he included $2 million in the recently approved House transportation bill to lay the foundation for development of a regional transportation incident coordination program and center. The TPB had previously approved a work plan for the coordination program and center, known as CapCOM. CapCOM will be responsible for region-wide transportation coordination and communications on a day-to-day basis and during major incidents. It is anticipated that CapCOM will someday become part of a larger organization with a broader scope including transportation and public safety interagency coordination and communication.

The CapCOM center will host an electronic information clearinghouse – RITIS, or Regional Integrated Transportation Information System. RITIS, which falls under the purview of CapCOM and is managed by the University of Maryland's CATT lab, is a software system that contains fused transportation-related data from a number of regional agencies and makes that data accessible to participating regional agencies. In simple terms, it can be thought of as a central, consolidated collection of regional transportation data. Currently, agencies from the Northern Virginia area, Maryland, and the District of Columbia are participating in the RITIS project.

RITIS is envisioned to contain:

- Near-real-time incident data from Maryland's CHART system.
- Volume and speed data from Maryland's CHART system.
- Near-real-time incident data from DC (DC uses the CHART software system).
- Near-real-time incident data from the NOVA STC.[16]
- Speed and volume data from the NOVA STC.
- Valuable, accurate transportation data to feed the region-wide 511 system and ultimately satisfy the motoring public's need-to-know in the region with regard to traffic and transportation.

[16] This is not yet feasible for NOVA since many of their current incident management processes are largely paper-based and manual. Once NOVA gets a new operating system, the sharing of this information with RITIS can be automated, and near-real-time.

It is envisioned that data available in RITIS will support, at a minimum, the following purposes:

- Regional 511 traveler information system.
- Regional web-based portal for information viewing/sharing (similar to VDOT's pilot information sharing portal, VTIP).
- Regional data archive analysis.
- Used by CapCOM for facilitating regional real-time cooperative operation.
- Used by NOVA and other agencies for system integration.
- Used by Homeland Security, other ISPs, media, etc.

In addition, according to the NOVA Regional ITS Architecture, there is a vision to provide RITIS with even more NOVA data than currently planned. Specifically, there is a vision among NOVA ITS stakeholders to share relevant data with RITIS, including:

- VDOT VOIS data (VOIS is a source of data for the state-wide 511 system)
- NOVA maintenance and construction data
- STSS data
- GIS data

Once this happens, RITIS will surely have an unmatched collection of meaningful regional transportation information to share in a single location. RITIS will be able to offer nearly "one-stop-shopping" for transportation information to participating agencies. RITIS is solidly positioned to become the regional transportation information clearinghouse. If the plans become a reality, RITIS is sure to become a valuable operational tool and a national model.

Capital Wireless Integrated Network (CapWIN)

CapWIN, or Capital Wireless Integrated Network, is a suite of tools for mobile and fixed-station first responders and support staff to provide in-vehicle mobile data communications in times of crisis and major incidents. CapWIN is a communication network that allows several emergency agencies across multiple jurisdictions in the Virginia, Maryland, and DC areas to communicate with one another; this is especially useful for field staff. This includes police, fire, and other emergency management agencies and allows efficient coordination and communication among the agencies to handle major incidents and emergency situations in the regional area.

CapWIN brings together first responders from a variety of agencies which have different missions and goals; this is nationwide and quite unique. Specifically, it is the first time in the Washington D.C. Region that public safety and transportation officials have come together using a cutting-edge technological solution to solve communication problems.

Federal Agencies

Due to the region's unique requirements, NOVA STC interacts with Federal law enforcement agencies (e.g., FBI, Capital Police, Secret Service, etc.) and other Federal installations. During regional large-scale emergencies, Federal law enforcement agencies take the lead in working with the STC for response and recovery operations.

National Park Service (NPS)

Another important regional system is the National Park Service (NPS), specifically pertaining to the operations of George Washington Parkway. The Virginia National Park Services is expected to send incident and work zone information to the NOVA STC and Maryland CHART on the roadways that are owned and maintained by the NPS. This enables STC and CHART to provide accurate road condition information to their travelers when using the George Washington (GW) Parkway or the Baltimore-Washington Parkway. When RITIS is available, NSP can simply provide such information to RITIS for use by the regional agencies.

Information Exchange Network (IEN)

The IEN is a separate computer system from the traffic controller's workstation and allows traffic controllers to input incident information that impact regional travel on I-95. This information is used by members of the I-95 Corridor Coalition, along with information provided by many other agencies to monitor incidents from the State of Florida to Maine.

Metropolitan Washington Airports Authority (MWAA) Center

The Metropolitan Washington Airports Authority provides parking information and road congestion information at the two airports in the NOVA region.

Virginia Railway Express (VRE) Center

The Virginia Railway Express (VRE) provides commuter rail service in the Virginia area. The VRE center coordinates with STC to provide multimodal transit information including parking information.

Washington Metropolitan Area Transit Authority Bus and Rail Operations Centers

The Washington Metropolitan Area Transit Authority is responsible for providing transit services via bus and rail to the Washington Metropolitan region. In the NOVA region, this includes the rail system as well as an extensive bus system. The NOVA STC is in communication with various WMATA operations centers including the WMATA Bus Operations Control Center, WMATA Rail Operations Center, WMATA Parking Management Center, and WMATA Customer Service Center to share information about incidents, service disruptions, and other operational information such as maintenance and construction alerts and weather alerts.

6 NOVA REGIONAL OPERATING CONCEPT

6.1 Introduction

An operating concept is a high-level description of an Intelligent Transportation System that emphasizes the roles and relationships of key stakeholders. The operating concept does not define inter-relationships in detail but rather represents an "executive summary" or "big picture" view of the system, showing major system elements and their general relationships in the long-term (10-year) view.

This section presents the Regional Operating Concept for NOVA. The operating concept presented here describes a future point in time when all programmed NOVA ITS components have been implemented. As such, it includes both elements that are currently in place and those that are anticipated to be implemented approximately over the next 10 years.

The Regional Operating Concept will evolve along with NOVA's ITS program, VDOT's statewide ITS program, and in response to ITS activities undertaken by other public and private organizations. One such example is the operation of High Occupancy Toll (HOT) lanes in the NOVA Region by a private entity under the Public-Private Transportation Act, expected for 2006. The HOT Lane operators will need to develop a Concept of Operations, in coordination with NOVA and other key regional transportation organizations whose activities will impact and be impacted by the HOT Lanes. They will need to integrate the HOT activities into the broader, coordinated, regional ITS system described in the NOVA Regional Operating Concept. The VDOT regionalization initiative, which will organize activities into various regions throughout the state, is a good example of VDOT statewide activities that must be incorporated into the NOVA Regional Operating Concept, and the Program Plan, over time.

6.2 Organization of the Regional Operating Concept

The NOVA Regional Operating Concept is presented in three tiers with each successive tier providing greater detail. This organization allows users with varying needs for detail to view the operating concept at whatever level best fits their needs and perspectives. The organization of the operating concept is shown in Figure 6-1.

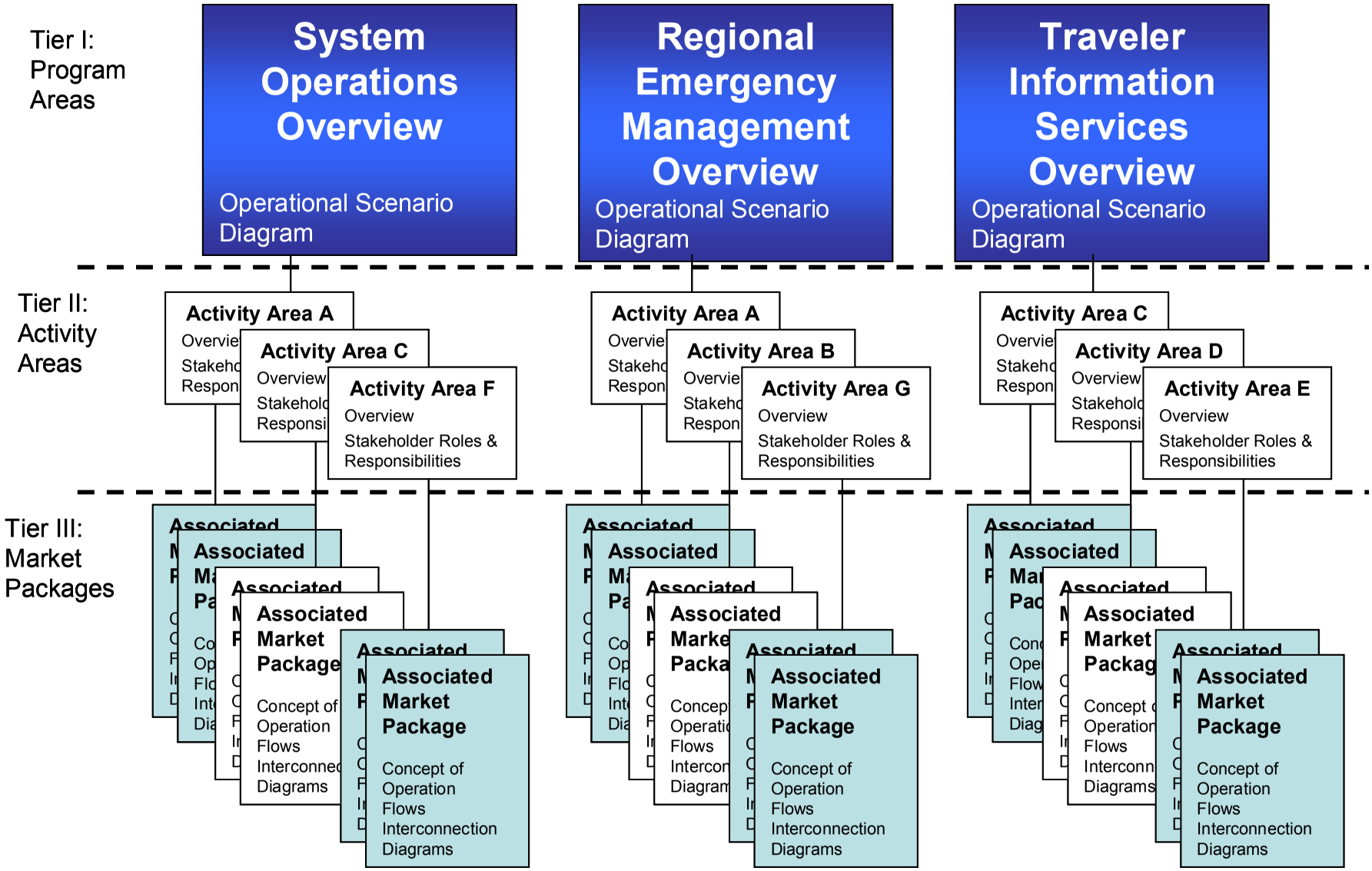

Figure 6-1. Organization of the NOVA Regional Operating Concept

6.2.1 Tier I – Program Areas

At the highest level, the NOVA Regional Operating Concept consists of three "program areas":

1) Systems Operations – encompassing all day-to-day management activities including freeway corridor management, surface street control, etc.
2) Regional Emergency Management – encompassing all activities related to large-scale emergencies such as evacuations.
3) Traveler Information – encompassing all traveler information services such as variable message signs and highway advisory radio.

The key distinction between the System Operations Program Area and the Regional Emergency Management Program Area is that the former encompasses only "typical" traffic incidents of the sort that happen on a daily basis and which have limited, localized impacts, i.e., limited to a few miles of several adjacent roadways. ITS elements and activities associated with less frequent, larger-scale incidents and emergencies that have regional impacts, such as those entailing evacuations (i.e., large hazardous materials spills, hurricanes, etc.), are encompassed in the Regional Emergency Management Program Area.

The program areas encompass all of the major NOVA ITS functions. Tier I information consists of: a brief description of the program area; a high-level diagram highlighting the major ITS components utilized in the program area and the most important of the relationships among those elements; and a brief "operational scenario" narrative describing how the activities of the program area would be carried out within the context of a hypothetical real-world ITS scenario. Tier I information provides the highest level understanding of NOVA ITS operations such as may be useful for policy-maker and non-transportation audiences.

6.2.2 Tier II – Program Activity Areas

The next level of detail, Tier II of the operating concept, identifies the 11 NOVA ITS "program activity areas":

1) Archived Data Management
2) Electronic Toll Collection
3) Emergency Management
4) Corridor Management
5) Incident Management
6) Maintenance and Construction Management
7) Parking Management
8) Surface Street Management
9) Transit Coordination
10) Traveler Information
11) Snow- and Weather-Related Operations

These activity areas correspond to the "Roles and Responsibility areas" in the NOVA Turbo Architecture ("Turbo Architecture" is the United States Department of Transportation system architecture software that has been utilized by NOVA to document their regional system architecture). As indicated in Figure 6-1, these 11 activity areas are associated with the three program areas (any given activity area may play a role in multiple program areas.) This level (Tier II) includes the following information for each activity area: a brief summary description of the activity area; a listing of the participating stakeholders and their roles and responsibilities; and a listing of associated "market packages" from the NOVA regional system architecture. This tier provides a level of detail that is most appropriate to NOVA ITS stakeholders in that it identifies their roles and responsibilities and how they relate to other stakeholders.

6.2.3 Tier III – Market Packages

The final, most detailed level of the NOVA ITS Regional Operating Concept, Tier III, consists of "market packages", which are concepts from the NOVA ITS System Architecture. Market packages represent slices of the ITS Physical Architecture that address specific services like broadcast traveler information, HOV lane management, surface signal control, etc. A market package encompasses several different subsystems, equipment packages, terminators, and architecture flows necessary to provide a given ITS service. The National ITS Architecture has identified a comprehensive list of 85 market packages. In the development of the NOVA regional ITS architecture, 45 of those market packages were selected for the NOVA region. In addition to providing the most detailed picture of the ITS subsystems and activities underlying the NOVA Regional Operating Concept, the association with market packages provides a "hardwire" link from the operating concept to the NOVA Regional ITS Architecture. Market packages are a central organizing concept in the architecture. Via the market package connection, the relationship between any component of the operating concept and the entirety of the system architecture can be traced. The system architecture provides rich detail on ITS stakeholders, the ITS elements they are associated with, information exchanges, and standards.

The level of detail presented in this tier will be of most interest to those within NOVA stakeholder organizations with technical ITS responsibilities and who have broad familiarity with ITS architecture concepts. This operating concept does not present all of the information associated with market packages, which is quite extensive. Rather, it lists the market packages and directs users to the NOVA Architecture website (www.vdot-itsarch.com). The market package information at the website includes identification of the interfaces (interconnections, information flows) between ITS systems and concept of operations for each market package (market package descriptions).

6.3 Tier I – Program Areas

6.3.1 *System Operations*

Scenario: It's 5:00 PM on a Friday and westbound traffic on the SR-267-Dulles Toll Road leading out of the Washington, D.C. area is heavy. A few moments ago, a passenger car and semi-tractor trailer carrying furniture collided while passing beneath I-495. The car came to rest in the outside travel lane and the truck careened off the right shoulder and smashed into one of the support columns for the overpass. Traffic immediately comes to a stop in the two outside lanes and slows to a trickle in the inside lanes. Within minutes, the traffic back-up extends approximately two miles to I-66 and traffic flow on I-66 begins to slow.

Within moments of the collision, system operators at the NOVA Smart Traffic Center—which is responsible for operating the Dulles Toll Road—begin receiving notifications of the incident from the local 911 center (via Fairfax CAD), which has received cell phone calls from travelers; from one of their own SSP operators who has come upon the incident scene; from Dulles Toll Road administration building staff; and from their traffic detectors in the roadway which flag sudden slow-downs as potential incidents. The STC operators spring into action, immediately:

- *Entering the incident into their incident database from which the information passes to the Regional Integrated Transportation Information System, which provides access to the information by regional and local transportation and emergency coordination organizations, including CapCOM and to the Virginia Operations Information System, a state-wide information sharing system.*
- *Zooming in on the scene using a closed-circuit television traffic surveillance camera installed along the roadway to verify conditions.*
- *Establishing communication with appropriate state and local police and fire responders who have access to the CCTV images and whose computer-aided dispatch (radio) systems automatically display the incident database record input by the STC.*
- *Alerting the NOVA Smart Traffic Signal System operators of the incident with whom they share space in the Public Safety Transportation Operations Center.*
- *Dispatching NOVA maintenance staff to the incident scene to assist in debris removal and to investigate possible damage to the overpass.*
- *Alerting the operators of the DTR toll system to lift the toll until the incident is cleared in order to facilitate traffic flow.*
- *Alerting the operations center of the transit agency that operates buses on the shoulders of the DTR.*

Using their automatic vehicle location system, the STC operators are able to quickly determine that a second SSP vehicle is near the incident scene and dispatches them to the area. The en-route and on-scene SSP operators are able to gain a quick understanding of the overall incident scene by accessing CCTV images and talking to STC operators and as they gather information on-site they add it, via laptop computers and wireless communications, to the incident database record created by the STC, making up-to-the-minute information available to all those with access to the incident record. As the SSP arrives on the scene, STC operators ask SSP to take a picture of the damaged structure on which the control room CCTV could not have a clear view. SSP take the picture, record a voice message on the initial assessment, and send it to STC.

Upon verification of the incident scene and traffic impacts, the NOVA STSS operators put into place a traffic diversion plan. That plan includes close coordination with the STC staff responsible for activities on the DTR and implementation of a special, pre-defined traffic signal timing plan for signals on the adjacent arterial streets that will carry much of the diverted DTR traffic. STC operators then

communicate with SSP on-scene to direct traffic to the adjacent arterial streets and coordinate Area Headquarters maintenance staff to assist deploying traffic cones to guide the diversion traffic.

By 6:30 pm, backups extend to the 14th Street Bridge as first responders (police and fire) conclude their investigations and work begins on clearing the incident. Realizing that the incident is now beginning to affect operations on roadways operated by other jurisdictions, CapCOM operators alert DC traffic operators, Maryland CHART, and GW Parkway operators so that appropriate message can be posted onto electronic Variable Message Signs in DC and Maryland so travelers can avoid getting onto I-66, which leads to DTR.

In addition to the many immediate actions taken by the STC to involve and coordinate with those agencies responsible for clearing the incident and managing traffic, a number of actions are taken to advise travelers of the incident, including:

- *The STC posts messages on several roadside electronic Variable Message Signs on several roadways impacted by the incident, including the DTR, I-495 and I-66.*
- *The STC relays incident information to several commercial media outlets for their dissemination to travelers.*
- *Drawing on the incident information entered by the STC into the VOIS, the Virginia 511 state-wide traveler information system posts advisory messages on their website (511virginia.org) and telephone information system.*

Travelers at various locations and in various stages of their trip can access these information sources to learn about the DTR incident and adjust their plans accordingly. Commuters hearing about the incident via commercial radio or 511 Virginia could choose to postpone their departure from work or to plan an alternate route or even switch to transit. Drivers on roadways several miles upstream of the incident seeing VMS messages or hearing traffic radio reports could choose to stop off and run errands, allowing time for the incident scene to clear, or could detour to an alternative route. Even those motorists close to the incident scene and having few options other than waiting it out will value the incident information made available to them. The information can help reduce their sense of confusion and frustration and may at least allow them to adjust their travel time expectations, and increase their awareness and caution as they pass through the congested area, including the incident scene itself.

At 7:00 pm, all lanes on DTR are open to traffic. After the incident is cleared, the traffic congestion lasts another hour. Therefore, the STC operators adjust messages to the travelers urging caution driving through the congested area and informing them of the reason for the abnormal traffic condition.

The scenario above highlights how the NOVA ITS system would be utilized to address the sort of freeway traffic accidents that occur frequently on heavily traveled roadways in the NOVA region and which have a limited, local-scale traffic impact. These sorts of activities comprise the "Systems Operations" component of the Regional Operating Concept. This area include responsibilities carried out by various agencies with the NOVA geographic boundary to manage roadways and transit systems, including freeway corridor management (incident surveillance, traveler information), traffic signal system operations, and local-scale incident management (including coordination between roadway, transit, and emergency response organizations). Systems Operations includes planning, design, construction, maintenance, and operational functions. Key elements of the Systems Operation Program Area include: NOVA Smart Traffic Centers and the roadway infrastructure they operate on both freeways and state highways (e.g., surveillance cameras, variable message signs, highway advisory radio, vehicle detector stations,

traffic signal systems, etc.); police, fire, and other emergency response dispatch centers and field units; and transit agency dispatch centers and vehicle fleets.

Many of the basic System Operations elements are currently in place. However, NOVA aims to improve safety and efficiency by expanding and improving the integration of these elements. Expansion and integration activities include strengthening linkages between transportation operations, law enforcement, and incident response groups; expanding and enhancing real-time traffic surveillance and management; and moving toward a corridor rather than individual roadway-oriented approach to freeway and surface street management.

Figure 6-2 presents a high-level graphical summary of the System Operations Program Area of the NOVA Regional Operating Concept. The diagram includes the major ITS elements and associated stakeholders, as well as their major interactions. The diagram contains three types of elements:

- Centers – these are the "command and control" nodes from which system operations are carried out. In many cases, such as with the NOVA Smart Traffic Center or transit agency dispatch offices, these are staffed physical facilities. Some centers may consist solely of data processing and communications infrastructure and, further, may be "virtual" in the sense that the associated hardware and software reside at various locations. Major staffed physical centers are represented in the NOVA Regional Operating Concept diagrams with office building icons. Other centers – typically those that don't include major staffed physical facilities – are represented with computer server icons.
- Field infrastructure – these consist of the various equipment that the agencies engaged in NOVA region system operations activities utilize to carry out specific strategies. Examples include devices associated with corridor management (closed-circuit television cameras, variable message signs, etc.), police and fire vehicles, service patrol vehicles, etc.
- Linkages – these consist of arrows and associated text labels highlighting the major relationships and information exchanges between centers and field infrastructure. Only very high-level, major relationships are indicated and as such, these linkages represent a simplification of the much more complex "interconnects" and "architecture flows" depicted in the NOVA regional system architecture. That level of detail can be accessed by examining the market packages associated with each of the activity areas that comprise each of the three NOVA Regional Operating Concept program areas.

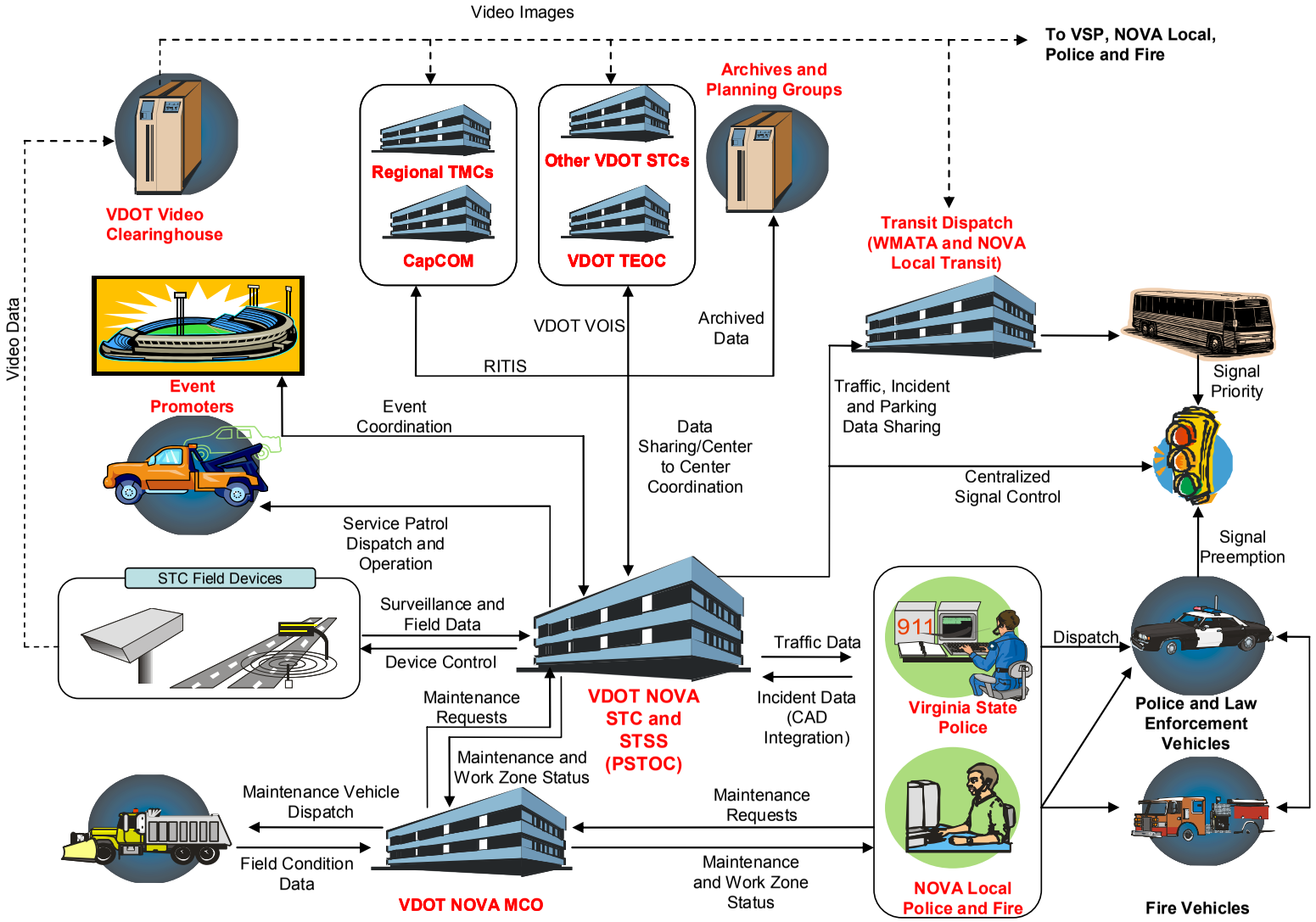

Figure 6-2. Operating Concept Diagram: System Operations

Figure 6-2 highlights the major day-to-day transportation system operations carried out in the NOVA region. Foremost among these are those associated with the NOVA Smart Traffic Center and Smart Traffic Signal System. These are the centers from which NOVA freeway corridor management and traffic signal operations are directed. As indicated in Figure 6-2, the STC and STSS share data and coordinate activities with several other centers, including NOVA Maintenance and Construction Operations; VDOT STCs located in other Districts; state-wide VDOT transportation facilities (e.g., the TEOC located in Richmond that coordinates large-scale incidents and emergencies); non-VDOT regional and local traffic management centers and systems (e.g., CHART, CapCOM, which coordinates incident-related transportation communications and response activities in the Washington D.C. Region); state and local law enforcement and other emergency responders; and major transit systems, including regional systems like WMATA.

6.3.1.1 Related Activity Areas

The Systems Operations Program Area is carried out through nine activity areas. Any one of these activity areas may also play a role in one or more of the other two program areas that comprise the regional operating concept. The activity areas utilized in the System Operations program area consist of the following:

- Archived Data Management
- Electronic Toll Collection
- Corridor Management
- Incident Management
- Maintenance and Construction Management
- Parking Management
- Surface Street Management
- Transit Coordination
- Snow- and Weather-Related Operations

Activity areas constitute the second, more detailed tier of the NOVA Regional Operating Concept and are described in Section 6.4 of this document.

6.3.2 Regional Emergency Management

Scenario: The Federal Bureau of Investigation (FBI) has confirmed a bomb threat near Capitol Hill. The FBI immediately establishes communications with a range of Federal, regional, state and local emergency operations organizations and verifies the presence of the explosive. With input from Federal agencies and local governments, FBI has recommended an evacuation of a 5-mile radius around Capitol Hill and communicates this information to the regional emergency management centers.

The emergency operations agencies immediately begin inputting information to, and coordinating with, one another via the Capitol Wireless Integrated Network, an interoperable first responder data communication and information sharing network system developed in partnership by the States of Maryland, Virginia, and the District of Columbia.

The NOVA STC immediately begins coordinating with a network of emergency operations agencies and local traffic and emergency response organizations. This coordination involves telephone calls as well as accessing information in, and as appropriate, contributing information to, the DC area using several communication networks (NAWAS, WAWAS, RICCS) etc. In the future, a Regional Integrated Transportation Information System will be used to coordinate information exchange. RITIS is an information sharing network that provides access to incident and emergency information by a wide range of regional and local transportation and emergency coordination organizations, including CapCOM.

As the various emergency operations organizations mobilize, the Virginia State Police alerts the VDOT Traffic Emergency Operations Center, the state-wide focal point for VDOT emergency management, of the incident and the need to enlist VDOT's support in coordinating large scale evacuation, all aspects of which will be under the primary direction of emergency management organizations. The VDOT state-wide TEOC engages the Virginia Department of Emergency Management and coordinates the NOVA Smart Traffic Center and NOVA Smart Traffic Signal Systems, which are co-located in the Public Safety Transportation Operations Center.

Under the direction of the emergency management organizations having overall responsibility for the event, and drawing upon established regional evacuation plans, the NOVA STC and STSS implement a wide range of actions to facilitate the evacuation including:

- *Entering updates and road conditions on their incident database, from which the information passes to the Virginia Operations Information System, a state-wide information sharing system that feeds the 511 Virginia traveler information system (which includes both a website and state-wide telephone information system).*
- *Coordinating with toll road authorities to suspend tolls to facilitate traffic flow.*
- *Coordinating with transit providers including the Washington Metropolitan Area Transportation Authority to expedite the movement of buses in freeway corridors, including both the freeways and adjacent arterial streets with traffic signals operated by the STSS.*
- *Setting up a mobile unified command post which coordinates with local police, fire, and NOVA staff to serve as a single point of contact for information on field conditions.*
- *Utilizing Safety Service Patrol vehicles to observe traffic conditions in the field, identify, verify, and assist law enforcement and emergency responders with clearing incident scenes.*
- *Posting advisory messages on roadway variable message signs.*
- *Opening up gate controlled access to high occupancy vehicle lanes and other facilities.*
- *Monitoring traffic flow on various freeways throughout the region that are equipped with vehicle detectors (which monitor traffic flow for slow-downs indicative of incidents) and closed-circuit television cameras.*
- *Perform access control activities to divert and direct travelers to ensure smooth traffic flow during evacuations. Activities include changing lane control signs on I-66 WB, portable barricades on I-66 EB enabling only emergency vehicle use, use of VMS directing travelers not to enter the Washington D.C. Region, keeping the gates of the HOV lanes open for south bound traffic and coordination with Metropolitan Washington Airport Authority (MWAA) to warn vehicles leaving the Dulles and Reagan airports not to travel into DC.*

Travelers of all types—private and commercial vehicle operators, transit users, car-poolers, bicyclists, and pedestrians—receive travel information from a number of channels, in many of which the NOVA STC plays a role. En-route motorists see VMS messages, hear information from commercial traffic reporting services on their vehicle radios, and consult the 511 telephone traveler information system. Many travelers who have yet to leave their home or work place consult the 511 website. Transit riders receive most of their information from the transit operators, but much of that information reflects coordination between NOVA, CapCOM, and the transit operations center.

The scenario above highlights how the NOVA ITS system would be utilized in an emergency evacuation scenario. These activities are included in the Regional Emergency Management Program Area of the regional operating concept. This area encompasses all of the ITS elements and activities utilized in planning and responding to large-scale (i.e., with regional impacts) incidents and emergencies, such as those involving evacuations or closures of major transportation services. The System Operations Program Area focuses on day-to-day operations, including the frequently occurring localized traffic accidents and incidents. In that program area, inter-agency operational coordination is typically limited to interactions between one or a small number of local/regional traffic management, transit, and law enforcement agencies. The Regional Emergency Management Program Area, in contrast, encompasses scenarios which usually will involve coordination and communication among a much larger number of organizations. These can include both local/regional agencies as well as state-wide agencies such as TEOC and VDEM and even Federal agencies such as the Federal Emergency Management Agency (FEMA). These scenarios include natural and man-made disasters, weather-related emergencies, large special events, etc.

This Program Area 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. It includes coordination associated with Emergency Operations Centers that are activated at local, regional, state, and Federal levels for emergencies and the portable and transportable systems that support Incident Command System operations and coordinated emergency response involving multiple agencies.

Figure 6-3 presents a high-level graphical summary of the Regional Emergency Management Program Area of the NOVA traffic management center operating concept. The diagram includes the major ITS elements and associated stakeholders as well as their major interactions. Figure 6-3 features the same three basic types of elements as described in Section 6.3.1: centers, field infrastructure, and linkages.

In addition to the information contained in this report, several other documents also describe emergency transportation operations:

1) Shelter-in-Place Guidelines, Fairfax County.
2) A Guide to Emergency Operations, VDOT – describes roles and responsibilities of TEOC, STC, maintenance, etc.
3) ESF 1 – National Response Plan – shows the roles and responsibilities for Federal and state, etc. agencies during an emergency.
4) Tiger Team Procedures – VDOT has a "Tiger Team" plan that should play a critical role in deploying field experts to scenes.

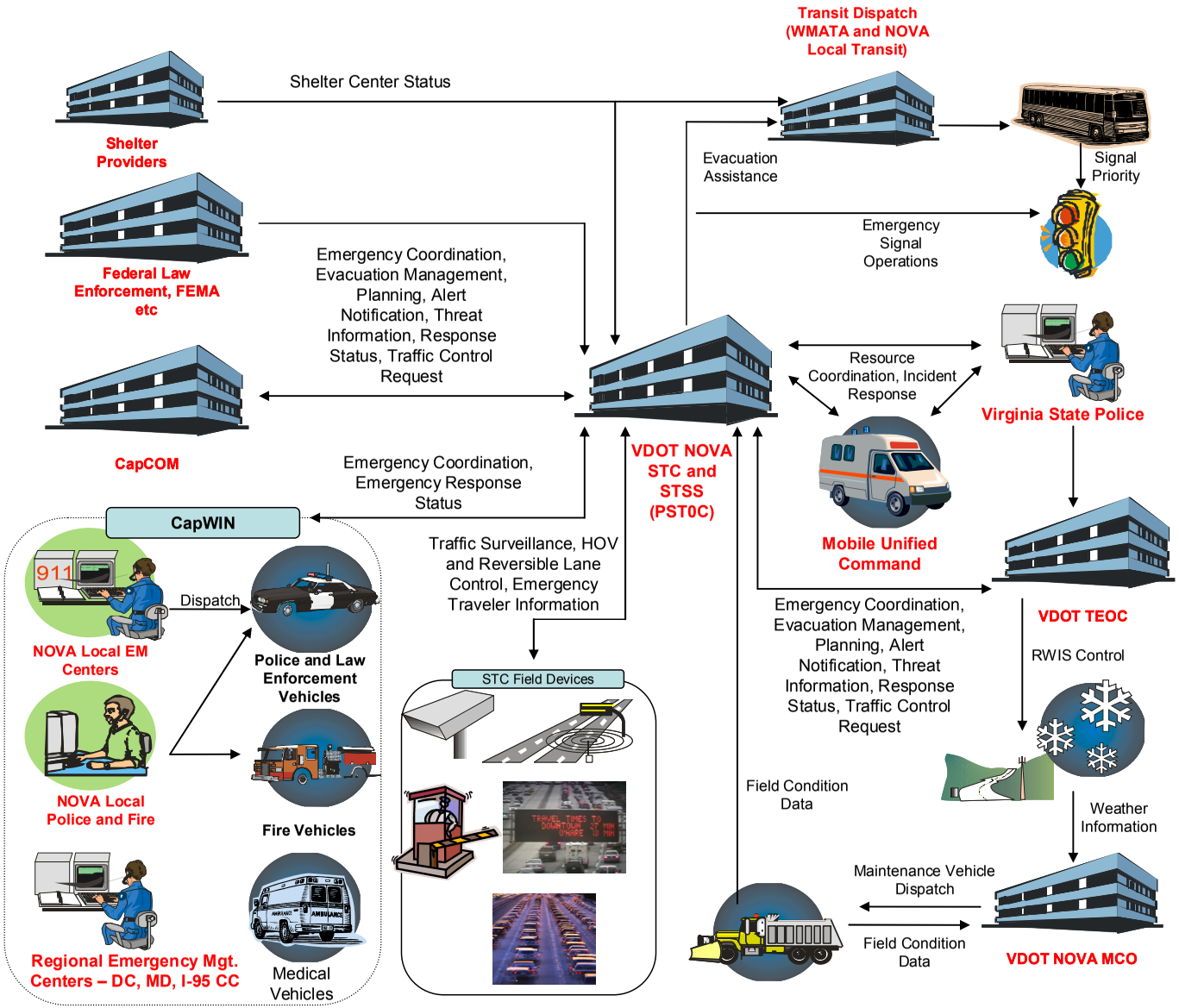

Figure 6-3. Operating Concept Diagram: Regional Emergency Management

In addition to these documents, many workshops have been conducted in the region including table-top exercises.

As in the System Operations Program Area, the NOVA Smart Traffic Center and Smart Traffic Signal System are at the center of NOVA view of the Regional Emergency Management Program Area. These are the centers from which NOVA corridor management and traffic signal operations are directed and these systems will play a major role in traffic control and traveler information dissemination associated with large-scale incidents. In addition to coordinating local activities with other local transportation, transit operators, and law enforcement, a higher degree of coordination and communication will extend to the VDOT state-wide Transportation Emergency Operations Center, FEMA, and the Red Cross and other organizations involved in shelter and evacuation operations. Activities within this program area will also entail greater coordination and communication with CapWIN, which provides the mobile public safety and transportation field communication tool to facilitate cross-discipline and jurisdiction communication and coordination in responding to significant incidents. For the most part, the field infrastructure and response strategies included in the Regional Emergency Management Program Area are the same as those utilized in the System Operations Program Area (surveillance cameras, variable message signs, 511 Virginia, service patrols, etc.) but carried out on a larger scale entailing a higher level of coordination with a broader range of agencies over a larger geographic area.

6.3.2.1 Related Activity Areas

The regional emergency management program area is carried out through the following four activity areas (any one of these activity areas may play a role in one or both of the other two operating concept program areas):

1) Incident Management
2) Emergency Management
3) Maintenance and Construction Management
4) Snow- and Weather-Related Operations

Activity areas constitute the second, more detailed tier of the NOVA Regional Operating Concept and are described in Section 6.4 of this document.

6.3.3 Traveler Information Services

Scenario: It's 6:30 PM on a summer Friday evening in the Washington, DC area. Between the commuter rush hour traffic and the typical weekend migration of travelers in and out of the city for recreation trips, traffic is heavy on most roads. Three of the millions of travelers impacted by conditions this evening are Richard, coming in from Richmond on I-95 to attend a large concert on the Mall; Dan, who works in D.C. and takes Metro to a suburban park-and-ride lot from which he drives home; and Jennifer, who commutes between her job at the National Postal Museum in Washington and her home in western Alexandria, Virginia.

Information on traffic conditions is available to these three travelers from a wide variety of sources, many of which are operated by, or utilize information provided by, the NOVA Smart Traffic Center and

their regional partners. Traveler information in the region is assembled from a number of sources including:

- *Telephone calls from travelers reporting incidents and other conditions*
- *Observations of incidents and other conditions by the State Police and other law enforcement*
- *Observations from the SSP vehicle operators who patrol roadways providing assistance to travelers and assisting with traffic incidents*
- *Observations from NOVA maintenance crews whose work throughout the system provides them a first-hand opportunity to observe conditions*
- *Telephone calls from the media reporting or inquiring about conditions*
- *Vehicle traffic detectors along roadways which monitor traffic flow and flag slow-downs that could be indicative of incidents*
- *Closed-circuit television surveillance cameras located along key freeways throughout the region and which are used by the STC and other traffic operators to monitor conditions and verify potential incidents*
- *Notices of planned maintenance and construction activities from a wide variety of transportation and utility agencies and private contractors conducting activities that could impact roadways*
- *Notices of special events provided by National Parks and commercial venues to the operators of the Virginia 511 state-wide traveler information system*
- *Commercial traffic reporting services operating their own information systems (e.g., websites) or who provide information to other information outlets (such as radio and television broadcasters) utilize their own roving vehicles, aerial surveillance, and other techniques to collect information.*

Information is collected by various organizations and entered into various systems operated by individual organizations. Much of the information collected by individual organizations is shared with other organizations in the region via a variety of means. For example, information sharing between commercial traffic services and the NOVA STC may occur by telephone or fax. The information on incidents collected by the STC from a variety of sources is entered into its own traffic management, then shared with the DC area Regional Integrated Transportation Information System. RITIS provides access to the information to a wide range of transportation organizations and provides STC access to information entered by those other organizations. STC traffic surveillance video images are also made available to other organizations via the NOVA Video Clearinghouse.

Our weekend tourist, Richard, coming into D.C. for the concert, obtains information from a number of sources. En-route from Richmond on I-95, Richard utilizes the 511 Virginia telephone information system to learn about incident-related congestion around the I-95 interchange with State Route 3 and chooses to detour onto US 1 through Fredericksburg. As he enters Washington, DC on I-395, he sees VMS messages alerting him of congestion on US 1—his usual approach to the Mall. Richard decides to stay on I-395 awhile longer and back-track slightly to the Mall from the east, avoiding much of the heavy traffic.

Meanwhile, Metro park-and-ride commuter Dan is stepping off at the Vienna Metro station. Walking to his car, Dan consults his combination cell phone/personal digital assistant for any traffic advisories for I-66 westbound, his usual route home to Centreville. Dan subscribes to a personalized commercial traffic information service that sends him e-mail advisories when there are incidents anywhere along his pre-defined favorite travel routes. Seeing no message, Dan knows that, despite the typical heavy traffic, his usual I-66 route is his best option.

Jennifer is finishing up her work for the day at the National Postal Museum and is just about ready to head to her car to start her trip home to Alexandria when she decides to check traffic conditions on the 511 Virginia website. Jennifer knows she faces two route options as she crosses the Potomac on I-395: either stay on I-395 or exit off onto US 1. Seeing that there are no unusual conditions on either road, Jennifer decides that she'll probably take her usual route, staying on I-395. Thirty minutes later as she is nearing her decision point, Jennifer checks the 511 Virginia phone system for an update and is alerted of a recent incident on I-395. Based on this up-to-the-minute information, Jennifer decides to take her alternative route, US 1.

The scenario above highlights how the Traveler Information Services portion of the NOVA ITS system would be utilized to provide information to auto and transit commuters as well as tourists traveling by automobile. This program area encompasses all of the systems and activities associated with delivering transportation information to travelers. Traveler information activities are one component of the System Operations and Regional Emergency Management Program Areas described in preceding sections but are explored in much greater detail in this program area. A separate program area for traveler information is appropriate given the very wide range of information types, collection and dissemination mechanisms, and responsible organizations. The two other program areas focus on the entirety of day-to-day operations and large-scale emergency operations and do not fully explore traveler information operations.

Traveler Information Services refer to services geared towards the end users of the transportation system—e.g., drivers, transit riders, etc. This information provides a number of benefits, including facilitating travel decisions that minimize exposure to incidents and congestion, contributing to travel time savings, accident reductions, fuel and emissions savings and reduction of traveler frustration. Most of the information utilized in the Traveler Information Services Program Area will be contributed through the surveillance, verification, and reporting mechanisms utilized on a daily basis in the Systems Operations Program Area as part of incident management, maintenance and construction operations, and freeway corridor management. A final distinguishing feature of the Traveler Information Services Program Area is that it includes, to a greater extent, interactions, including various types of current and potential partnerships with, commercial Information Service Providers (ISPs). These ISPs include special-purpose transportation information providers and the traditional broadcast media.

NOVA and other public agencies will disseminate real-time en-route information such as traffic conditions, status of Park-n-Ride lots, and construction activities, directly to travelers via highway advisory radio, variable message signs, 511 Virginia, highway helpline, and the Internet. Special transit information may be conveyed to motorists at strategic locations through variable message signs and highway advisory radio. Commercial ISPs will augment these public traveler information dissemination activities both by distributing the same information via their own channels, and by providing various types of enhanced or personalized information, including on-demand traveler services information (attractions, food, and lodging), route guidance, and customized traffic and weather information tailored to specific customers. The availability of these services will enhance the quality of travel and will promote tourism in the region. The Information Service Providers will provide packaged information through in-vehicle devices, dial-up services, personal digital assistants, the Internet, television, and radio stations.

Also included in the Traveler Information Services Program Area are in-vehicle "Mayday" systems. These systems will allow quick and automated identification of disabled vehicles and serious accidents in remote areas. When triggered by a serious crash, or activated by the driver, the location of the event will be communicated to an Information Service Provider who will then forward the information to local emergency services and NOVA. The local emergency service will send appropriate help to the affected vehicle and NOVA will support the effort by managing the traffic at the location of the incident.

Figure 6-4 presents a high-level graphical summary of the Traveler Information Service program area of the NOVA Regional Operating Concept. The diagram includes the major ITS elements and associated stakeholders as well as their major interactions. Figure 6-4 features the same three basic types of elements as described in Section 6.3.1: centers, field infrastructure, and linkages.

From left to right, Figure 6-4 is generally organized according to the flow of traveler information. On the far left are several of the key primary sources of information including non-NOVA transportation management systems such as information from CapCOM, made available to NOVA and all other participating agencies via the planned RITIS; NOVA operated traffic flow detectors and surveillance cameras; NOVA maintenance and construction operations; and information entered by state and local police and fire agencies made available to the NOVA STC via CAD data sharing systems. The central and right portions of Figure 6-4 show how the NOVA STC disseminates various types of traveler information directly using their roadside infrastructure (variable message signs and highway advisory radio) and shares that information—such as through the state-wide Virginia Operations Information System—with other transportation organizations, state-wide VDOT systems like 511 Virginia (telephone and Internet), and commercial information providers.

6.3.3.1 Related Activity Areas

The Traveler Information Services program area is carried out through the following four activity areas (any one of these activity areas may play a role in one or both of the other program areas):

1) Traveler Information
2) Emergency Management
3) Transit Coordination
4) Snow- and Weather-Related Operations

Activity areas constitute the second, more detailed tier of the NOVA Regional Operating Concept and are described in Section 6.4 of this document.

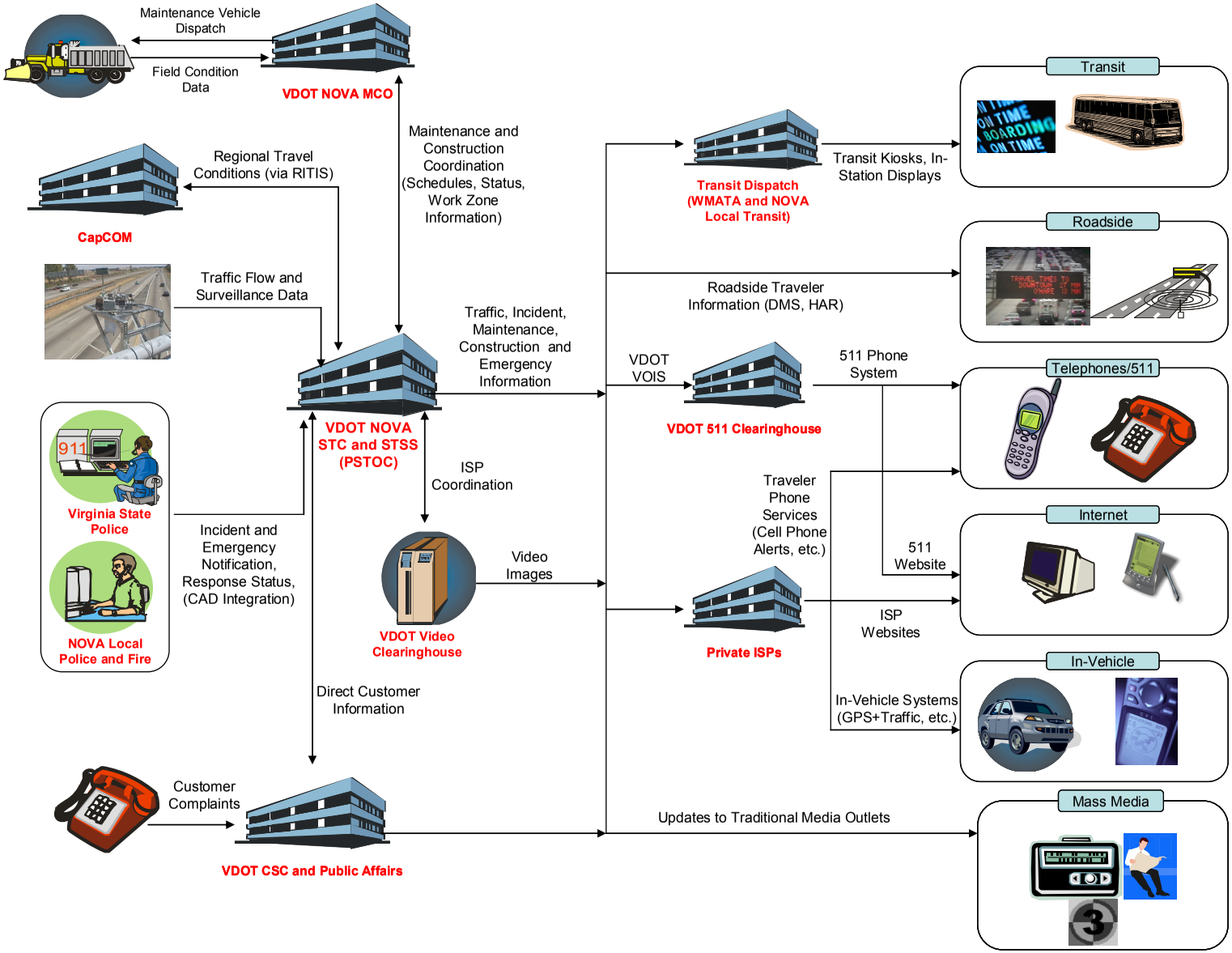

Figure 6-4. Operating Concept Diagram: Traveler Information Services

6.4 Tier II – Program Activity Area Descriptions

This section describes each of the 11 NOVA ITS Program Activity Areas. In Section 6.3, the association between each of the three NOVA ITS Program Areas and the various activity areas was identified. For each activity area, a short summary of operations is provided followed by a table that identifies specific roles and responsibilities for each participating stakeholder and a list of associated market packages. Table 6-1 shows the mapping of activity areas to program areas. Additional information on the market packages is presented in Section 6.5.

Table 6-1. Program Activity Areas to Program Area Mapping

Program Activity Areas	Program Areas		
	System Operations	Regional Emergency Management	Traveler Information Services
Archived Data Management	✓		
Electronic Toll Collection	✓		
Emergency Management		✓	✓
Corridor Management	✓		
Incident Management	✓	✓	
Maintenance and Construction Management	✓	✓	
Parking Management	✓		
Surface Street Management	✓		
Transit Coordination	✓		✓
Traveler Information			✓
Snow- and Weather-Related Operations	✓	✓	✓

6.4.1 Archived Data Management

NOVA in coordination with the VDOT Central Office collects, archives, manages, and distributes data generated from ITS sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. Archived Data Management Systems (ADMS) have been developed by the University of Virginia (UVA) Smart Travel Lab (STL) and are now being migrated to VDOT. The STL is responsible for research and collects and provides archive data to NOVA sections, transit and council of government clearinghouses, and other archive users like research and data collection facilities at local universities (George Mason, University of Maryland, etc.).

6.4.1.1 Stakeholder Roles and Responsibilities

Table 6-2 identifies the major stakeholders involved in the Archived Data Management Activity Area and summarizes their major existing and planned role and responsibilities.

Table 6-2. Archived Data Management Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
Local Universities and Research Facilities	Conduct research and analysis using archived data for NOVA	Existing
University of Virginia	Perform on-line analysis and mining of data to provide STC and STSS with data products	Existing
	Provide capabilities to access in-place data from geographically diverse archives and coordinate information exchange to a local data warehouse	Existing
	Receive and archive data from the NOVA STC and the NOVA STSS	Existing
VDOT Central Office	Collect, archive, and manage ITS and non-ITS data from various sources	Existing
	Perform the role of a state-wide archived data management system (ADMS)	Existing
	Provide archive data products upon requests to other VDOT and non-VDOT agencies (MWCOG, USDOT, etc.)	Existing
NOVA	Provide traffic data to Smart Travel Lab for archive	Existing

6.4.1.2 Associated Market Packages

The Archived Data Management Activity Area utilizes the following market packages:

- AD1– ITS Data Mart

6.4.2 Electronic Toll Collection

There are two major toll facilities in NOVA – the Dulles Toll Road and the Dulles Greenway. The Dulles Toll Road is operated by NOVA whereas the Dulles Greenway is currently operated by a private agency.

The VDOT Toll Administration system – Smart Tag Center – provides general payment administration capabilities and supports the electronic transfer of authenticated funds from the customer to the transportation system operators for all Virginia toll facilities. Recently, VDOT toll facilities started to accept E-ZPass toll tags ensuring compatibility with the toll administration in the I-95 corridor states.

6.4.2.1 Stakeholders Roles and Responsibilities

Table 6-3 identifies the major stakeholders involved in the Electronic Toll Collection Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-3. Electronic Toll Collection Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
Dulles Greenway	Collect tolls from users of the Greenway	Existing
	Perform toll administration and coordination with other toll agencies including the Dulles Toll Road, E-ZPass, Smart Tag Center, and other Virginia Toll Road facilities	Existing
	In the future, provide vehicle toll tag data to STC for traffic management and traveler information	Planned
VDOT Central Office – Administration	Operate the Smart Tag Center that handles toll administration including back-office and financial administration of Virginia's toll facilities	Existing
	Collect tolls from users of Dulles Toll Road	Existing
	Coordinate with Greenway Center, E-ZPass, etc. for toll administration	Existing
	In the future, provide vehicle toll tag data to STC for traffic management and traveler information	Planned
	Collect tolls from users on facilities including Powhite, Parkway George P. Coleman Bridge, and other toll facilities	Existing

6.4.2.2 Associated Market Packages

The Electronic Toll Collection Activity Area utilizes the following market packages:

- ATMS10 – Electronic Toll Collection

6.4.3 Emergency Management

The NOVA region's public safety, emergency management, and other allied agency systems support incident management, disaster response and evacuation, security monitoring, and other security and public safety-oriented ITS applications. These systems include 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. It includes the functions associated with Emergency Operations Centers that are activated at local, regional, state, and Federal levels for emergencies and the portable and transportable systems that support Incident Command System operations at an incident.

NOVA and VDOT Central Office manage sensor and surveillance equipment used to enhance transportation security of the roadway infrastructure (including bridges, tunnels, interchanges, and other key roadway segments) while transit agencies manage surveillance equipment on the public transportation system (including transit vehicles, public areas such as transit stops and stations, facilities such as transit yards, and transit infrastructure such as rail, bridges, tunnels, or bus guideways).

Various regional agencies including VSP monitor alerts, advisories, and other threat information and prepare for and respond to identified emergencies. Coordinated emergency response involving multiple agencies is performed through CapWIN, CapCOM, and Federal law enforcement agencies (FBI, Secret Service, etc.).

6.4.3.1 Stakeholder Roles and Responsibilities

Table 6-4 identifies the major stakeholders involved in the Emergency Management Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-4. Emergency Management Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
CapCOM	Create, store, and utilize emergency response plans to facilitate coordinated response	Planned
	Broadcast wide area alerts and advisories for emergency situations such as severe weather events, civil emergencies, child abduction (AMBER Alert), and other situations that pose a threat to life and property where information must be immediately provided to the public	Planned
	Provide emergency response plans or event plans	Planned
	Support coordination of transportation management plans for emergencies	Planned
	Enhance the ability of the surface transportation system to respond and recover from disasters	Planned
	Identify the key points of integration between transportation systems and public safety, emergency management, and other allied organizations that form the overall disaster response	Planned
	Interface with other transportation agencies to support coordinated emergency response involving multiple agencies	Planned
	Use real-time traffic information received from other transportation agencies to aid efficient dispatch of emergency vehicles	Planned
	Provide disaster-related traveler information to the general public including evacuation and re-entry information; and other information concerning the operation of the transportation system during a disaster	Planned
	Provide emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided along with evacuation routes, destinations and anticipated travel conditions	Planned

Stakeholder	Roles and Responsibilities	Status
CapWIN	Create/store and utilize emergency/incident response plans to facilitate coordinated response	Existing
	Interface with other transportation agencies to support coordinated emergency response involving multiple agencies	Existing
	Provide emergency response plans or event plans	Existing
	Support the coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing
	Track and manage emergency vehicle fleets using AVL technology and two-way communications with vehicle fleet	Existing
	Use real-time traffic information received from other transportation agencies to aid the dispatcher in selecting the emergency vehicles and routes that will provide a timely response	Existing
District of Columbia Public Safety and Emergency Management	Conduct offensive operations to mitigate a hazardous material emergency	Existing
	Coordinate evacuation plans among allied agencies and manage evacuation and re-entry of population in the vicinity of a disaster or other emergency that poses as a risk to security	Existing
	Interface with other transportation management agencies to support coordinated emergency response involving multiple agencies	Existing
	Maintain centralized emergency management system	Existing
	Monitor and detect potential, looming, and actual disasters including natural and man-made disasters	Existing
	Receive mayday messages and security alarms, determine an appropriate response, and either use internal resources or contact a local agency to provide that response	Existing
	Provide emergency response plans or event plans	Existing
	Receive landline public safety calls and forward to appropriate dispatch center	Existing
	Support coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing
Federal Agencies	Create/store and utilize emergency/incident response plans to facilitate coordinated response	Existing
	Monitor and detect potential, looming, and actual disasters including natural and man-made disasters	Existing
Federal Law Enforcement	Interface with other transportation agencies to support coordinated emergency response involving multiple agencies	Planned
	Support coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Planned
I-95 Corridor Coalition	Interface with other transportation agencies to support coordinated emergency response involving multiple agencies	Existing
	Support coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing

Stakeholder	Roles and Responsibilities	Status
Maryland State Highway Administration (MDSHA)	Interface with other transportation agencies to support coordinated emergency response involving multiple agencies	Existing
Media	Provide disaster and emergency traveler information including alerts and advisories through television and FM radio broadcasts, etc.	Existing
Metropolitan Washington Airport Authority (MWAA)	Receive mayday messages and security alarms, determine an appropriate response, and either use internal resources or contact a local agency to provide the response	Existing
National Park Service	Interface with other transportation agencies to support coordinated emergency response involving multiple agencies on BW Parkway, GW Parkway, and other NPS facilities in the DC-MD-VA region	Existing
NOVA Local Public Safety and Emergency Management Agencies	Interface with other transportation agencies to support coordinated emergency response involving multiple agencies	Existing
	Provide emergency response plans or event plans	Existing
	Support the coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing
	Track and manage emergency vehicle fleets using AVL technology and two-way communications with vehicle fleet	Existing
NOVA Local Signal Agencies	Develop, propose, and implement emergency control strategies during major emergencies (all signals on blink, contraflow, etc.)	Planned
	Support the coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Planned
NOVA Local Transit Agencies	Notify travelers of emergency schedule information, routes, and fares	Existing
	Provide emergency transit service for evacuation	Planned
Shelter Providers	Provide shelter and medical care during natural and man-made disasters	Existing
VDOT Central Office – Administration (Dulles Toll Road)	Support the coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation using the Dulles Toll Road	Planned
VDOT Central Office – Emergency Management	Coordinate evacuation plans among allied agencies and manage evacuation and re-entry of population in the vicinity of a disaster or other emergency that poses as a risk to security	Existing
	Interface with other transportation management agencies to support coordinated emergency response involving multiple agencies	Existing
	Maintain centralized emergency management system	Existing
	Support coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing
VDOT Districts	Coordinate evacuation plans among allied agencies and manage evacuation and re-entry of population in the vicinity of a disaster or other emergency that poses as a risk to security	Planned

Stakeholder	Roles and Responsibilities	Status
NOVA	Coordinate evacuation plans among allied agencies and manage evacuation and re-entry of population in the vicinity of a disaster or other emergency that poses as a risk to security	Existing
	Interface with other transportation management agencies to support coordinated emergency response involving multiple agencies	Existing
	Use signal technicians (on stand-by; Tiger Team) to repair NOVA and other areas signal system during emergencies	Existing
	Support coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing
Virginia Public Safety and Emergency Management	Conduct offensive operations to mitigate a hazardous material emergency	Existing
	Coordinate evacuation plans among allied agencies and manages evacuation and re-entry of population in the vicinity of a disaster or other emergency that poses as a risk to security	Existing
	Interface with other transportation management agencies to support coordinated emergency response involving multiple agencies	Existing
	Maintain centralized emergency management system	Existing
	Monitor and detect potential, looming, and actual disasters including natural and man-made disasters	Existing
	Receive mayday messages and security alarms, determine an appropriate response, and either use internal resources or contact a local agency to provide that response	Existing
	Provide emergency response plans or event plans	Existing
	Receive landline public safety calls and forward to appropriate dispatch center	Existing
	Support coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing
Virginia State Police	Conduct offensive operations to mitigate a hazardous material emergency	Existing
	Coordinate evacuation plans among allied agencies and manages evacuation and re-entry of population in the vicinity of a disaster or other emergency that poses as a risk to security	Existing
	Receive mayday messages and security alarms, determines an appropriate response, and either uses internal resources or contact a local agency to provide that response	Existing
	Provide emergency response plans or event plans	Existing
	Support coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing

Stakeholder	Roles and Responsibilities	Status
Washington Metropolitan Area Transit Authority	Conduct offensive operations to mitigate a hazardous material emergency	Existing
	Create/store and utilize emergency/incident response plans to facilitate coordinated response	Existing
	Maintain centralized emergency management system	Existing
	Monitor video images and audio surveillance data collected in secure areas including those frequented by travelers and those typically away from travelers (tunnels, bridges, roadway infrastructure, etc.)	Existing
	Provide security for public facilities owned by agency	Existing
	Support the coordination of evacuation plans among Federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation	Existing
	Use real-time traffic information received from other transportation agencies to aid the dispatcher in selecting the emergency vehicles and routes that will provide a timely response	Existing

6.4.3.2 Associated Market Packages

The Emergency Management Activity Area utilizes the following market packages:

- EM 2 – Emergency Routing
- EM 5 – Transportation Infrastructure Protection
- EM 6 – Wide Area Alert
- EM 7 – Early Warning System
- EM 8 – Disaster Response and Recovery
- EM 9 – Evacuation and Reentry Management
- EM 10 – Disaster Traveler Information

6.4.4 Corridor Management

NOVA's Freeway Management System became operational in 1985 and is located in the Smart Traffic Center. NOVA STC is a nerve center of an integrated system of advanced technologies including computer software, traffic cameras, lane control strategies, ramp meters, reversible control gates, and HOV lane restrictions. From the STC, NOVA monitors and manages traffic, recognizes and responds to incidents, and delivers traveler information to motorists. STC operates and controls field devices that are typically located along the roadside in aiding the traffic monitoring and traffic management. In addition, STC operators constantly communicate with the Safety Service Patrollers in clearing and managing incidents.

STC and SSP share incident data in real-time via the same database. STC will soon be able to view SSP locations in order to dispatch patrollers to incident scenes more efficiently and SSP is equipped to take snap shots of incidents with cell phones when needed, share that information with the STC operators, and view any of the CCTV cameras that STC operates in their vehicles.

The STC also coordinates with other agencies for responding to incidents and emergencies and participates in a regional incident management plan. STC is currently leading the contract for sharing CCTV images with public safety and other transportation management centers in the Washington DC region.

It is a state-wide plan to make the existing STCs (including NOVA STC) into regional traffic management centers with the capability to monitor and control systems beyond the NOVA boundaries. Research is currently underway to study the boundaries and the roles and responsibilities of the STCs. It is likely that NOVA STC's roles and responsibilities will change when the regional concept is in effect.

Other functions of the STC include the support of the Department of Environmental Quality in roadside emission testing, share traffic data with those agencies that promote ride sharing and parking management, support testing and evaluation of new systems and concepts for improved operations and management in conjunction with the Smart Travel Lab, integrate with existing and planned regional systems (e.g., MD, VA, WMATA, etc.), and coordinate with other VDOT Districts (Fredericksburg, Culpepper, Richmond, and Staunton) and the state-wide operation center. The STC and signal operations will be housed in the local-state co-located Public Safety & Transportation Operation Center in November 2007 with Fairfax County and Virginia State Police. STC operates numerous field devices for managing traffic, including: CCTV cameras, variable message signs, HOV gate control, ramp meters, vehicle detection, lane control signals, call boxes, and truck rollover systems.

6.4.4.1 Stakeholder Roles and Responsibilities

Table 6-5 identifies the major stakeholders involved in the Corridor Management Activity Area and summarizes their major existing and planned roles and responsibilities.

6.4.4.2 Associated Market Packages

The Corridor Management Activity Area utilizes the following market packages:

- ATMS 1 – Network Surveillance
- ATMS 2 – Probe Surveillance
- ATMS 4 – Freeway Control
- ATMS 5 – HOV Lane Management
- ATMS 6 – Traffic Information Dissemination
- ATMS 7 – Regional Traffic Control
- ATMS 9 – Traffic Forecast and Demand Mgmt
- ATMS 19 – Speed Monitoring
- ATMS 20 – Drawbridge Management
- ATMS 21 – Roadway Closure Management

Table 6-5. Corridor Management Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
NOVA	Collect and process automated traffic data from traffic speed monitoring sites	Existing
	Manage and monitor traffic on freeway mainlines and on-off ramps using field equipment including cameras, inductive loops, and non-intrusive equipment	Existing
	Manage HOV lanes by coordinating freeway ramp gates and connector signals with HOV lane usage signs	Existing
	Monitor weather conditions along freeways	Existing
	Propose and facilitate the appropriate dissemination of incident-related information to travelers and potential travelers	Existing
	Provide the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways	Existing
	Provide the roadside elements of traffic information dissemination including VMS and HAR	Existing
	Share traffic information with other traffic agencies like DDOT, ITMS, or CHART	Existing
	Utilize current technology to optimize the flow of traffic on access controlled highways	Existing
Video Clearinghouses	Post traffic image data from NOVA CCTV cameras in an accessible format on a website	Existing
	Share traffic image data with non-VDOT agencies including law enforcement and emergency management	Existing
Virginia State Police	Coordinate with STC for incident response and management	Existing
	Respond to incidents on NOVA interstates	Existing

6.4.5 Incident Management

The incident management system is highly integrated with the traffic management system. The Smart Traffic Center provides all dispatching and two-way radio capability, highway advisory radio, collection of real-time data to detect incidents, and CCTV's to verify incidents. Additionally, STC monitors the Virginia State Police CAD system for incident detection and are looking into automatic system integration with VSP CAD and Fairfax County (etc. local) CAD systems as the main means of automatic incident detection. A majority of the incident and emergency management functions are performed by the NOVA STC. In addition to the STC, the NOVA Safety Service Patrol assists and performs emergency functions, incident clearance, on-scene traffic management, and incident management data entry (shared real-time between STC and SSP). The safety service patrol is responsible for identifying and responding to incidents that occur on NOVA's roadway system. The SSP also identifies incident locations, monitors the impact of incidents, verifies incidents, and shares incident information with STC and other agencies, along with removing or assisting in removing obstructions from the incident scene.

The incident information sharing responsibility mainly resides with STC; however, SSP does share with other agencies' field staff (e.g., police and other DOT patrollers) via CapWIN and phone calls. During incidents in which traffic is expected to spill onto arterial corridors, STC operators notify the signal operation staff to implement appropriate signal timing plans to facilitate different traffic volumes and patterns.

Incident management is also a major function of the VSP, which responds to incidents on the state's roadway system.

Incident notification is also exchanged with regional agencies like CapWIN, CapCOM, DC Public Safety and Emergency Management, DC DOT, MDSHA CHART, toll facilities, event promoters, and local jurisdictions. Incident information is also provided to private ISPs, media, state-wide 511 services (through VDOT VOIS) and other traveler information outlets from the STC.

6.4.5.1 Stakeholder Roles and Responsibilities

Table 6-6 identifies the major stakeholders involved in the Incident Management Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-6. Incident Management Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
CapCOM	Interface with other transportation agencies to support coordinated emergency/incident response involving multiple agencies	Planned
	Propose and facilitate the appropriate control of traffic signals or other traffic control to reduce traffic flow impacts of an incident	Planned
	Track incidents and responses	Planned
	Alert agencies of conditions including time and location of hazardous conditions that may cause an incident	Planned
	Provide capability to disseminate information relating to response status to other agencies	Planned
	Allow coordinated selection/determination of the procedures, including alternate routes, needed for the resolution of each incident and provide the procedures to those agencies responding to the incident	Planned
	Provide the capability to identify existing (both planned and unplanned) incidents	Planned
CapWIN	Propose and dispatch appropriate service vehicles to an incident	Planned
	Provide resources when requested by emergency/incident management responders	Planned
	Provide status of all resources needed for incident resolution to those agencies responding to the incident	Planned
District of Columbia Public Safety and Emergency Management	Interface with other transportation agencies to support coordinated emergency/incident response involving multiple agencies in District of Columbia	Existing

Table 6-6. Incident Management Roles and Responsibilities (Continued)

Stakeholder	Roles and Responsibilities	Status
Dulles Greenway	Interface with NOVA other transportation agencies to support coordinated emergency/incident response involving multiple agencies on the Dulles Greenway	Existing
Event Promoters	Notify traffic management and law enforcement of event information	Existing
	Work with traffic management and law enforcement on event plans and event-related traffic control coordination	Existing
Freight Rail Operators	Provide rail-related incident information to emergency management and traffic management agencies	Planned
I-95 Corridor Coalition	Interface with NOVA and other transportation agencies to support coordinated emergency/incident response involving multiple agencies on the I-95 corridor	Existing
Maryland State Highway Administration (MDSHA)	Interface with NOVA and other transportation agencies to support coordinated emergency/incident response involving multiple agencies on the I-95 corridor	Existing
Media	Provide incident notification to the general public	Existing
National Park Services – VA	Coordinate incident response and management for events related to GW parkway with agencies within NOVA as well as local public safety and traffic management agencies	Existing
NOVA Local Public Safety and Emergency Management Agencies	Provide additional resources when requested by emergency/incident management responders	Existing
	Respond to incidents on city streets and arterials including assuming incident command at the scene	Existing
NOVA Local Signal Agencies	Determine the expected traffic flow impact of each incident	Existing
	Propose and facilitate the appropriate control of traffic signals and other devices to reduce the traffic flow impact of an incident	Existing
	Provide status of all resources needed for incident resolution to those agencies responding to the incident	Existing
NOVA Local Transit Agencies	Modify schedules if warranted due to incidents	Existing
	Provide schedule delay and incident information to travelers	Existing
	Provide transit incident information to traffic management and public safety agencies	Existing
Regional ISPs	Provide incident information to travelers and potential travelers through e-alerts, cell phones, websites, etc.	Existing
	Receive incident reports and status updates from traffic management and emergency management agencies in the region	Existing
VDOT Central Office	For major incidents such as hazmat spills with long cleanup times or incidents with long-term infrastructure damage, play a role in coordinating incident response and management through TEOC	Existing
VDOT Districts	Coordinate with NOVA STCs for incident response and management	Planned

Table 6-6. Incident Management Roles and Responsibilities (Continued)

Stakeholder	Roles and Responsibilities	Status
NOVA	Propose and facilitate appropriate traffic management strategy to reduce traffic flow impact	Existing
	Provide resources when requested by emergency/incident management agencies	Existing
	Provide the capability to disseminate the information relating to the response status to other agencies	Existing
	Provide the Safety Service Patrol to respond to incidents and disabled vehicles on interstates	Existing
	Share information on appropriate dissemination devices such as VMS and HAR	Existing
	Track incidents and responses	Existing
Video Clearinghouses	Provide traffic images to verify and monitor incidents to law enforcement and traffic management agencies	Existing
Virginia State Police	Provide CAD integration with regional traffic management agencies and ISPs	Existing
	Respond to incident reports on VDOT interstates and Dulles Greenway	Existing
Washington Metropolitan Area Transit Authority	Provide transit incident information to traffic management, emergency management, and ISPs	Existing
	Respond to incidents on the transit property	Existing

6.4.5.2 Associated Market Packages

The Incident Management Activity Area utilizes the following market packages:

- EM1 – Emergency Call Taking
- EM 4 – Roadway Service Patrol
- ATMS 8 – Traffic Incident Management
- CVO 10 – Hazmat Management

6.4.6 Maintenance and Construction Management

NOVA Maintenance and Construction Operations (MCO) is carried out through maintenance facilities throughout the region. These Area Headquarters (AHQ) monitor and manage roadway infrastructure construction and maintenance activities. AHQ manages fleets of maintenance, construction, or special service vehicles (e.g., snow and ice control equipment). The AHQ centers receive a wide range of status information from these vehicles and perform vehicle dispatch, routing, and resource management for the vehicle fleets and associated equipment. AHQ centers also participate in incident response by deploying maintenance and construction resources to an incident scene in coordination with other centers. A new division, the VDOT ITS IMC (Inspection, Maintenance, and Construction) manages the repair and maintenance of equipment such as traffic controllers, detectors, variable message signs, signals,

pavement marking, traffic static signs, and other equipment associated with the operational roadway infrastructure.

6.4.6.1 Stakeholder Roles and Responsibilities

Table 6-7 identifies the major stakeholders involved in the Maintenance and Construction Management Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-7. Maintenance and Construction Management Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
National Park Services – VA	Coordinate with NOVA STC, STSS about maintenance and construction work plans and schedules	Existing
	Perform maintenance and construction operations for George Washington Parkway	Existing
VDOT Central Office	Provide road weather conditions, advisories, and alerts to STC from state-wide RWIS stations	Existing
	Coordinate with VDOT divisions and other local and regional agencies during major construction activities	Planned
NOVA	Collect and archive maintenance and construction data for off-line planning, research, and archiving	Existing
	Collect current road and weather conditions using data collected from environmental sensors deployed on or about the roadway that is managed by Central Office	Existing
	Communicate and track maintenance and construction vehicles and other equipment to ascertain progress of their activities	Existing
	Disseminate maintenance and construction activity coordination to centers that can utilize it as part of its operations, or to the ISPs who can provide the information to the travelers	Existing
	Manage winter road maintenance, tracking and controlling snow plow operations, and roadway treatment (e.g., salt spraying and other material applications) based on weather information	Existing
	Perform vehicle maintenance scheduling and manage both routine and corrective maintenance activities on vehicles and other MCO equipment	Existing
	Provide numerous services for scheduled and unscheduled maintenance and construction of roadway system or right-of-way. Maintenance services would include landscape maintenance, hazard removal (roadway debris, dead animals), and routine maintenance activities (roadway cleaning, grass-cutting)	Existing
	Repair and maintenance of ITS equipment on the roadway (signs, traffic controllers, traffic detectors, VMS, signals, CCTV, etc.)	Existing
	Maintain AVL systems for maintenance vehicles	Planned

Table 6-10. Transit Coordination Roles and Responsibilities (Continued)

6.4.6.2 Associated Market Packages

The Maintenance and Construction Management Activity Area utilizes the following market packages:

- MC 1 – Maintenance and Construction Vehicle and Equipment Tracking
- MC 2 – Maintenance and Construction Vehicle Maintenance
- MC 7 – Roadway Maintenance and Construction
- MC 8 – Work Zone Management
- MC 10 – MC Activity Coordination

6.4.7 Parking Management

NOVA would like to enhance monitoring and management of parking facilities, especially Park-n-Ride lots owned by NOVA, and promote multimodal traffic management measures to minimize unnecessary traffic circulation on the roadway network or in the parking lots. Enhancements would include management of parking operations and current parking status information dissemination. Regionally, there is expected to be coordination between the NOVA Parking Facilities and WMATA and VRE Parking Management to enable regional parking management strategies, especially during special events.

6.4.7.1 Stakeholder Roles and Responsibilities

Table 6-8 identifies the major stakeholders involved in the Parking Management Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-8. Parking Management Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
Metropolitan Washington Airport Authority (MWAA)	Detect and classify vehicles entering and exiting the parking facility and measure parking facility occupancy to support parking operations and traveler information services	Planned
	Determine and distribute the dynamic status of individual parking lots	Planned
	Supports electronic payment of parking fees	Planned
Regional ISPs	Receive data from parking lot operators and provide real-time (occupancy) and static parking (rates, locations) to travelers	Planned
NOVA	Determine and distribute dynamic status of individual parking lots (full, open, etc.)	Planned
Virginia Railway Express (VRE)	Determine and distribute dynamic status of individual parking lots (full, open, etc.)	Planned
	Manage parking reservations, parking lot use, and revenue collection for VRE parking facilities	Planned

Table 6-10. Transit Coordination Roles and Responsibilities (Continued)

Stakeholder	Roles and Responsibilities	Status
Washington Metropolitan Area Transit Authority	Maintain and distribute static information about individual parking faculties including hours of operations, rates, lot locations, lot entrance locations, capacity, lot type (open, covered, parking), etc.	Existing
	Manage parking reservations, parking lot use, and revenue collection for parking facilities	Existing
	Support electronic payment of parking fees	Existing
	Determine and distribute the dynamic status of individual parking lots (full, open, etc.)	Planned

6.4.7.2 Associated Market Packages

The Parking Management Activity Area utilizes the following market packages:

- ATMS 16 – Parking Facility Management
- ATMS 17 – Regional Parking Management

6.4.8 Surface Street Management

NOVA STC installs, monitors, controls, and maintains over 1,000 traffic signals in three counties: Fairfax, Loudoun, and Prince William. NOVA STC is able to manage traffic flow continuously, monitor real-time signal status, collect traffic flow information, and adjust signal timing from a centralized traffic signal control system, the Smart Traffic Signal System. The STSS includes roughly 1,200 intersections that NOVA maintains and operates and the number continues to increase as the region expands. The NOVA STC staff can manage the flow of traffic by making remote adjustments to signal timings within the system. Surface Street Management also includes management of roadside field devices on arterials such as traffic controllers for the traffic signal system, CCTV, and vehicle detection equipment. Several local cities also manage or maintain signal systems on portions of arterials.

6.4.8.1 Stakeholder Roles and Responsibilities

Table 6-9 identifies the major stakeholders involved in the Surface Street Management Activity Area and summarizes their major existing and planned roles and responsibilities.

6.4.8.2 Associated Market Packages

The Surface Street Management Activity Area utilizes the following market packages:

- ATMS 1 – Network Surveillance
- ATMS 3 – Surface Street Control
- ATMS 6 – Traffic Information Dissemination
- ATMS 7 – Regional Traffic Control
- ATMS 21 – Roadway Closure Management

Table 6-10. Transit Coordination Roles and Responsibilities (Continued)

6.4.9 Transit Coordination

The NOVA region depends heavily on the services provided by transit agencies. NOVA Local Transit Agencies provide basic transit service and paratransit service in Northern Virginia. WMATA provides transit bus and rail service while VRE provides commuter rail service in the Washington DC metropolitan area.

Table 6-9. Surface Street Management Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
NOVA Local Signal Agencies	Coordinate with other regional agencies during emergencies and evacuation for emergency traffic control	Existing
	Maintain field equipment including traffic signals and vehicle detection equipment	Existing
	Manage regional traffic control efforts and assist in coordinating traffic across boundaries	Existing
	Monitor maintenance, construction, and winter road conditions along key arterials	Existing
	Receive signal priority and preemption requests where available	Existing
NOVA	Adjust signal timing in real-time from a centralized traffic signal control system – STSS	Existing
	Continuously monitor the real-time signal status and collect traffic flow information using CCTV and loop detectors	Existing
	Coordinate with other regional agencies during emergencies and evacuation for emergency traffic control	Existing
	Manage regional traffic control efforts and assist in coordinating traffic across boundaries	Existing
	Monitor maintenance, construction, and winter road conditions along key arterials	Existing
	Receive signal priority and preemption requests where available	Existing
	Use surveillance technologies to detect and verify incidents	Existing
	Install and maintain over 1000 traffic signals in the three counties – Fairfax, Prince William, and Loudon	Planned

Communication between transit departments and with other operating entities such as emergency response services and traffic management systems are critical to the region. NOVA coordinates traffic, incident, and transit information through direct communications with the transit agencies. Several transit agencies furnish travelers with real-time travel information, continuously updated schedules, schedule adherence information, transfer options, and transit routes and fares. Several pilot projects exist in the region to convey real-time information to the traveler using a variety of means including 511, kiosks, message signs, Internet, etc.

Transit coordination during emergencies is also a major sub-activity to allow coordinated use of transit vehicles to facilitate response to major emergencies or evacuations. Such coordination could include use of toll facilities, HOV lanes, contraflow lanes, and use of shoulders, etc.

Table 6-10. Transit Coordination Roles and Responsibilities (Continued)

Traffic signal priority for transit buses is being considered by local jurisdictions as well as NOVA to improve schedule adherence of transit agencies and the overall roadway network usage efficiency.

6.4.9.1 Stakeholder Roles and Responsibilities

Table 6-10 identifies the major stakeholders involved in the Transit Coordination Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-10. Transit Coordination Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
Metropolitan Washington Airport Authority (MWAA)	Coordinate schedules and services with other transit providers for regional transit management	Existing
NOVA Local Transit Agencies	Coordinate schedule and service with WMATA and other transit agencies in the region	Existing
	Operate Bus Service in local jurisdictions in the NOVA region (City of Alexandria – DASH, City of Fairfax – CUE, Fairfax County – Fairfax Connector Transit, Arlington County – ART and STAR, – Loudoun (LCTA and Express Bus), Springfield (TAGS Metro Springfield Circulator), Falls Church Bus, and Potomac and Rappahannock Transportation Commission (PRTC – services offered are fixed and paratransit))	Existing
	Provide transit traveler information through various sources including websites, telephones, and other personal information access services	Existing
	Provide transit vehicle tracking functions using AVL technology and two-way communications with fleet	Existing
	Provide the capability for transit buses to request transit signal priority through short range communications directly with traffic control equipment	Planned
Regional Transit Electronic Clearinghouse	Coordinate fare management between multiple transit agencies using a common fare card system such as SmarTrip. Also serve as a regional transit information clearinghouse	Existing
NOVA	Notify transit agencies of incidents and traffic conditions	Existing
	Monitor Park-n-Ride locations and provide parking system status to transit agencies	Planned
	Provide capability for local Traffic Signal Priority for transit vehicles along major arterials	Planned
Virginia Railway Express (VRE)	Provide traveler information through various sources including websites, telephones, and other personal information access services	Existing
	Coordinate schedules and services with other transit providers for regional transit management	Existing
	Provide train arrival, schedule delay, incident information, and ADA required access information on in-station displays	Existing

Table 6-10. Transit Coordination Roles and Responsibilities (Continued)

Stakeholder	Roles and Responsibilities	Status
Washington Metropolitan Area Transit Authority	Coordinate schedules and services with other transit providers for regional transit management	Existing
	Monitor train movement on mainlines and in yards. Collect and monitor information about railcar, train revenue and non-revenue mileage, and schedule adherence	Existing
	Provide automatic train control	Existing
	Provide dispatch function and tracking for bus operators	Existing
	Provide in-station and in-bus fare boxes, garage and central fare processing equipment for fare collection and passenger counts	Existing
	Provide SmartTrip-SMRT service that provides overall management and coordination for fare collection programs and ridership statistics	Existing
	Provide subscription- based real-time system status, alerts and advisories to personal information access devices like emails, pagers, cell phones, etc.	Existing
	Provide train arrival, schedule delay, incident information, and ADA required access information on in-station displays	Existing
	Provide train movement and wayside device monitoring and control including third rail power	Existing
	Provide Internet website with bus and rail system maps, rail station information, parking information, bus and rail schedules (also downloadable to PDAs) and fares, trip planning, general alerts and advisories, accessibility and elevator/escalator status	Existing
	Provide the capability for transit buses to request transit signal priority through short range communications directly with traffic control equipment	Planned

6.4.9.2 Associated Market Packages

The Transit Coordination Activity Area utilizes the following market packages:

- APTS 2 – Transit Fixed Route Operations
- APTS 3 – Demand Response Transit Ops
- APTS 4 – Passenger and Fare Mgmt
- APTS 5 – Transit Security
- APTS 7 – Multimodal Coordination
- APTS 8 – Transit Traveler Information

6.4.10 Traveler Information

NOVA provides traveler information to the public through various dissemination media including 511, VMS, HAR and private media sources. NOVA also operates a customer service center that travelers can call for additional travel-related emergencies. NOVA also works with several private ISPs to provide on-demand traveler services information including descriptions of destinations and services, route guidance, and accurate traffic and weather conditions tailored specifically to the needs of their customers.

NOVA also shares video data through a central video clearinghouse to agencies and traveling public in the region. Metropolitan Washington regional traveler information is a need in the area and is being addressed by several regional initiatives such as the regional 511 initiatives and CapCOM.

6.4.10.1 Stakeholder Roles and Responsibilities

Table 6-11 identifies the major stakeholders involved in the Traveler Information Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-11. Traveler Information Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
CapCOM	Compile individual agency information into a regional picture of transportation conditions. Provide the regional information back to individual agencies	Planned
	Provide Regional Traveler information through the Internet and a regional 511 service for the DC-VA-MD area	Planned
	Using RITIS – Collect Regional traffic conditions, advisories, incident information, maintenance and construction information, winter road conditions, air quality and weather information from agencies including NOVA STC, CHART, DDOT ITMS/TOC, Local Traffic Management, Local Emergency Management, Maryland State Police, Virginia State Police, and other law enforcement agencies	Planned
Media	Coordinate with other public and private ISPs for traffic images and information	Existing
	Provide alerts, advisories to travelers to enable traveling public to make better informed decisions both pre-trip and en-route	Existing
	Provide regular traffic conditions information through traditional media (television, FM radio)	Existing
	Request traffic and incident information from information service providers and traffic management agencies (STC, STSS, CapCOM, etc.)	Existing
VDOT Central Office	Operate and service voice based traveler information systems like 511 which support traveler telephone information. Maintain a statewide video clearinghouse of traffic image data	Existing
	Provide disaster and emergency traveler information through TEOC for evacuation and re-entry management during natural and other catastrophes	Existing
	Provide road and weather conditions information to other transportation agencies using data from the state-wide RWIS network	Existing
NOVA	Collect and disseminate traffic conditions, advisories, incident information, maintenance and construction information, winter road conditions, air quality & weather information, and video data (through clearinghouse) to other agencies including adjacent STCs, other regional traffic management agencies like CHART, DDOT ITMS/TOC, CapCOM, and private ISPs	Existing
	Install and maintain detection (CCTV, Radar) and dissemination devices (VMS, HAR)	Planned
	Provide customer services including customer complaints, incident information, and maintenance and construction information	Planned
Virginia Smart Travel Program	Serve as the state-wide ATIS Clearinghouse for Virginia. Data from the clearinghouse will be used for 511 telephone and website services as well as other traveler dissemination methods	Planned

6.4.10.2 Associated Market Packages

The Traveler Information Activity Area utilizes the following market packages:

- ATIS 1 – Broadcast Traveler Information
- ATIS 2 – Interactive Traveler Information
- ATIS 9 – In-vehicle Signing

6.4.11 Snow- and Weather-Related Operations

NOVA uses information from weather information providers (the weather service and surface transportation weather service providers) and from the Road Weather Information System (RWIS) stations. This information is used to provide current and forecast weather information that can be fused with other data sources to support advanced decision support systems. These support systems increase the efficiency and effectiveness of winter maintenance operations (for example snow removal).

VDOT TEOC collects current road and weather conditions using data collected from environmental sensors associated with RWIS. In addition to fixed sensor stations at the roadside, sensing of the roadway environment from sensor systems located on NOVA maintenance and construction vehicles is planned. The collected environmental data is used by NOVA to make decisions on operations.

Real-time road condition information and current temperatures are used by NOVA system operators to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination market package, and aid operators in scheduling work activity.

Efforts are underway to enhance automated treatment systems such as treatments for fog dispersion, anti-icing chemicals, etc. When the environmental sensors detect adverse conditions, the automated treatment system will be activated and drivers will be notified of the system activation through variable message signs.

6.4.11.1 Stakeholder Roles and Responsibilities

Table 6-12 identifies the major stakeholders involved in the Snow- and Weather-Related Operations Activity Area and summarizes their major existing and planned roles and responsibilities.

Table 6-12. Snow- and Weather-Related Operations Roles and Responsibilities

Stakeholder	Roles and Responsibilities	Status
VDOT Central Office	Collect and disseminate RWIS station data to regional STCs and other stakeholders	Existing
	Operate RWIS stations in the NOVA region	Existing
	Provide notification and alert systems for state-wide weather related emergencies (hurricanes, etc.)	Existing
NOVA	Collect weather information from various sources (subscription weather services, national weather service, FEMA, etc.)	Existing
	Coordinate with NOVA Local Emergency Responders for incident clearance and snow removal activities	Existing
	Disseminate weather information to travelers and media through 511, HAR, as well the Internet	Existing
	Report snow and winter maintenance status to VDOT VOIS and other regional data clearinghouses such as RITIS	Existing
	Track Maintenance Vehicle Fleet Location and resource usage (including AVL implementation)	Existing
	Use weather information for operations decisions such as road closures, maintenance strategies, resource mobilization	Existing
	Perform snow-removal operations on interstate and surface streets in the NOVA region	Existing

6.4.11.2 Associated Market Packages

The Snow- and Weather-Related Operations Activity Area utilizes the following market packages:

- MC 3 – Road Weather Data Collection
- MC 4 – Weather Information Processing and Distribution
- MC 5 – Roadway Automated Treatment
- MC 6 – Winter Maintenance

6.5 Tier III – Market Packages

This section provides information on the final and most detailed tier of the NOVA Regional Operating Concept – market packages. Various market packages are utilized in various combinations within the 11 NOVA ITS Activity Areas, which in turn are combined in various ways to support the three NOVA ITS Program Areas. Market packages, which are thus directly related to the operating concept, provide traceability to the entirety of the NOVA Regional System Architecture.

Table 6-13 lists the NOVA region market packages. The items in the list are links to portions of the NOVA system architecture webpage which can be accessed at www.vdot-itsarch.com. Clicking on a system market package will provide a customized description of the market package (i.e., a concept of operations) and systems (elements) that are associated with it.

Hyperlinks to systems lead into other parts of the architecture. Future architecture enhancements will include a diagram for each market package.

Table 6-13. Activity Areas to Market Packages Mapping

Activity Areas	Market Packages
Archived Data Management	AD1 – ITS Data Mart
Electronic Toll Collection	ATMS10 – Electronic Toll Collection
Emergency Management	EM01 – Emergency Call-Taking and Dispatch EM02 – Emergency Routing EM05 – Transportation Infrastructure Protection EM06 – Wide-Area Alert EM07 – Early Warning System EM08 – Disaster Response and Recovery EM09 – Evacuation and Reentry Management EM10 – Disaster Traveler Information
Corridor Management	ATMS01 – Network Surveillance ATMS02 – Probe Surveillance ATMS21 – Roadway Closure Management ATMS05 – HOV Lane Management ATMS06 – Traffic Information Dissemination ATMS07 – Regional Traffic Control ATMS09 – Traffic Forecast and Demand Management ATMS18 – Reversible Lane Management ATMS19 – Speed Monitoring ATMS20 – Drawbridge Management ATMS04 – Freeway Control
Incident Management	ATMS08 – Traffic Incident Management System EM04 – Roadway Service Patrols EM01 – Emergency Call-Taking and Dispatch CVO10 – HAZMAT Management
Maintenance and Construction Management	MC01 – Maintenance and Construction Vehicle and Equipment Tracking MC02 – Maintenance and Construction Vehicle Maintenance MC07 – Roadway Maintenance and Construction MC08 – Work Zone Management MC10 – Maintenance and Construction Activity Coordination

Table 6-13. Activity Areas to Market Packages Mapping (Continued)

Activity Areas	Market Packages
Parking Management	ATMS16 – Parking Facility Management ATMS17 – Regional Parking Management
Surface Street Management	ATMS01 – Network Surveillance ATMS06 – Traffic Information Dissemination ATMS03 – Surface Street Control ATMS07 – Regional Traffic Control ATMS21 – Roadway Closure Management
Transit Coordination	APTS2 – Transit Fixed-Route Operations APTS3 – Demand Response Transit Operations APTS4 – Transit Passenger and Fare Management APTS5 – Transit Security APTS7 – Multimodal Coordination APTS8 – Transit Traveler Information
Traveler Information	ATIS1 – Broadcast Traveler Information ATIS2 – Interactive Traveler Information ATIS9 – In Vehicle Signing
Snow and Weather Related Operations	MC03 – Road Weather Data Collection MC04 – Weather Information Processing and Distribution MC05 – Roadway Automated Treatment MC06 – Winter Maintenance

The screenshots in Figure 6-5 illustrate the use of the website to view the market packages.

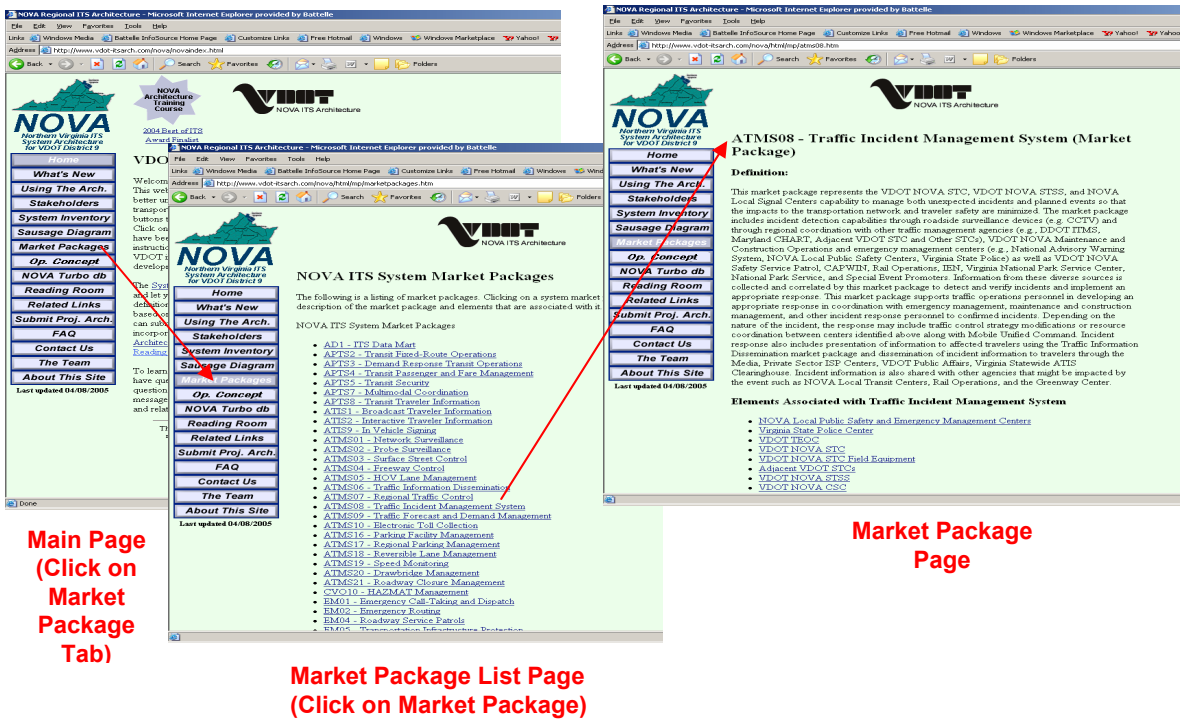

Figure 6-5. Market Package Descriptions on the Website

7 NOVA SMART TRAVEL PROJECTS

This Program Plan does not include a recommended list of ITS projects. Rather, it aims to provide project developers with the tools necessary to ensure that new projects are developed consistent with the plan. This section provides some examples of ITS projects, provides guidance for promoting ITS project consistency with this plan and the NOVA ITS architecture, summarizes the ITS project programming process, describes the process for evaluating and prioritizing proposed ITS projects, and presents guidance for the consideration of ITS elements in roadway projects.

7.1 ITS Project Examples

NOVA ITS projects are categorized into the following four general types:

Reinforcement – these types of projects involve upgrading existing equipment or communication linkages. Examples of projects of this type include software patches, lighting circuit reinforcements, retrofitting gate controllers, etc.

Replacement – these types of projects involve replacing existing equipment with new and improved systems. Examples of such projects include STC software replacement, CCTV replacement, loop replacements, etc.

Expansion – these types of projects increase the coverage of the ITS deployment. Examples include new VMS site locations, new CCTV installations, fiber-optic network expansion, etc.

Integration – these types of projects include both those that integrate ITS elements into non-ITS projects—like installing permanent CCTV or VMS as part of a roadway construction project—as well as projects that integrate various ITS elements, such as integrating or sharing Computer-Aided Dispatch systems among various emergency response agencies and with NOVA.

Table 7-1 presents examples of actual NOVA ITS projects, along with information showing how the projects relate to the overall ITS Program Activity Areas (presented in Section 6.0), Strategies (presented in Section 4.0) and Needs (presented in Section 3.0).

Table 7-1. NOVA ITS Project Examples

Example ITS Projects by Type	Related NOVA ITS Activity Area [1]	Related Strategy [2]	Related Need [2]
Reinforcement			
Lighting Circuit Reinforcement/Replacement (Evaluation, Design and Construction) To replace 1.6 MM ft cable for I-395/I-95 lighting circuit	• Maintenance and Construction Management	• Operate the transportation system effectively and efficiently	• Ensure that field equipment is functioning to serve operational needs
Gate Controller retrofit on I-395 Retrofit 53 HOV gate controller/arms on I-395 using B&B	• Maintenance and Construction Management	• Enhance public safety and enhance mobility using technology	• Ensure that field equipment is functioning to serve operational needs
Replacement			
STC Software Replacement To capture, analyze, and prioritize the requirements that will be used to modify the selected base traffic management software to meet existing and new STC needs; develop Concept of Operations (CONOPS) for developer to design system; select software developer; design software codes; testing; and phase-implementation	• Freeway and Corridor Management	• Operate the transportation system effectively and efficiently	• Improve NOVA and emergency responder coordination in field during incidents
CCTV Replacement Replace old CCTVs identified by TrafficLand assessment, relocate, remove, and procure new CCTVs as result of the Go-Forward assessment	• Maintenance and Construction Management • Freeway and Corridor Management	• Improve transportation security and expand ITS infrastructure	• Enhance traffic surveillance for travel time measurement • Expand STC coverage and capability to all NOVA freeway miles and critical arterial corridors
Loop Replacement Replace 161 loops with 40 RTMS	• Maintenance and Construction Management • Freeway and Corridor Management	• Enhance mobility using technology	• Ensure that field equipment is functioning to serve operational needs

Table 7-1. NOVA ITS Project Examples (Continued)

Example ITS Projects by Type	Related NOVA ITS Activity Area [1]	Related Strategy [2]	Related Need [2]
Expansion			
IMMS Expansion Expand STC's IMMS maintenance management database system to cover signal maintenance need	• Surface Street Management	• Operate the transportation system effectively and efficiently	• Enhance coordinated traffic signal system
VMS Deployment Deploy VMS on major arterial corridor where lead to interstate as the first phase and then deploy VMS along arterial corridors at strategic locations as later phases. Arterial corridors are identified in the Go-Forward Plan	• Freeway Corridor Management • Traveler Information	• Support traveler information services • Expand ITS infrastructure to enable corridor management	• Expand STC coverage and capability to all NOVA freeway miles and critical corridors
Arterial/Fiber Expansion Fairfax Co. Parkway from I-66 to I-95, I-495 from I-95 to DTR, Rt. 123 from I-95 to Rt. 1, Rt. 234 from I-95 to Rt. 1, and Rt. 1 from Rt. 234 to Rt. 123	• Surface Street Management	• Expand ITS infrastructure to enable corridor management	• **Expand STC coverage and capability to all NOVA freeway miles and critical corridors**
Integration			
VSP CAD/Integration Integrate with VSP CAD data to enable automatic incident detection	• Incident Management • Emergency Management	• Enhance public safety	• Integrated response and coordination especially during regional emergencies • Improve incident detection capability
Arterial System Integration **Integrate STSS system** detector data; deploy additional system detector on arterial roadways; integrate with STC software system for integrated incident management	• Surface Street Management	• Enhance public safety • Expand ITS infrastructure to enable corridor management	• Improve incident detection capability • Improve NOVA and emergency responder coordination in field during emergencies

[1] NOVA ITS activities are grouped into eleven "program area activities": Archived Data Management, Electronic Toll Collection, Emergency Management, Freeway Corridor Management, Incident Management, Maintenance and Construction Management, Parking Management, Surface Street Management, Transit Coordination, Traveler Information, and Winter Maintenance and Weather Information. These Activity Areas are described in Section 6.0.

[2] The relationships identified here are not comprehensive. For each project, only a few of the most direct relationships have been identified for illustrative purposes.

7.2 Guidance for Promoting Project Consistency

The essential considerations in developing proposed ITS projects are to:

- Maximize consistency with the NOVA Regional ITS Architecture
- Maximize consistency with the overall NOVA Smart Travel program direction (vision, goals, and objectives)
- Target projects to address identified stakeholder needs

Projects developed with these principles in mind will not only be consistent and effective, they will also be easier to fund since the project evaluation process will emphasize these same factors.

In addition to being consistent with the NOVA ITS program and architecture, there is a specific process for project development. This process varies slightly depending on whether the project focuses strictly on ITS or integrates ITS into a broader non-ITS project. These considerations—architecture and program consistency direction (including needs) and the project development process—are addressed in the sections below.

7.2.1 System Architecture Consistency

NOVA has developed a comprehensive regional ITS architecture to facilitate coordinated, effective ITS deployment in the region. The NOVA ITS Architecture Version 2.0[17] describes subsystems, interconnects, and information flows necessary to deploy an integrated transportation system in NOVA.

The architecture is a critical resource to NOVA ITS project developers and should be consulted very early in the process. The use of the architecture during project development has been discussed in the FAQ portion of the architecture website and also in a stand-alone document.[18]

ITS project developers should bear in mind that their specific project need not implement all of the functionality associated with any given area of the architecture. Failure to do so will not compromise consistency as long as the determination of which functions are to be implemented is performed in consideration of the architecture, a clear rationale is identified, and the question of architecture consistency is discussed with those at NOVA responsible for facilitating architecture consistency.

In addition to demonstrating consistency with the architecture—or providing a clear rationale for any proposed deviations—ITS project managers should be aware that the architecture provides a great deal of information that can assist them in developing their projects, including functional requirements statements and specific stakeholders.

[17] The NOVA Architecture is available at www.vdot-itsarch.com.

[18] Virginia DOT, Using the ITS Architecture for Project Development, April 2005.

7.2.2 ITS Program Direction Consistency

Demonstration of an ITS project's consistency with the overall NOVA ITS program is best accomplished by indicating how the project supports and responds to the goals, objectives, and stakeholder needs identified in this document. Similar to what is shown in Table 7-1, which identified a few examples of ITS projects in several categories, ITS project developers should identify specific relationships to goals, objectives, and needs. The project evaluation process will emphasize consistency with program direction, so a strong linkage between a specific project and that direction will facilitate project funding.

7.3 Overview of the ITS Programming and Implementation Process

Figure 7-1 illustrates, at a very high level, the major steps in the process to program and implement ITS projects, beginning after the point where a specific ITS project has been proposed by the sponsor/developer (the process up to that point will include the architecture and program plan consistency discussed in the preceding Section 7.2). Figure 7-1 pertains to the process utilized for "ITS-only" projects. Figure 7-2 summarizes the process used for projects that integrate ITS with traditional (that is, non-ITS) projects.

As indicated in the first row of Figure 7-1, the ITS Section evaluates and prioritizes proposed ITS projects and seeks funding for them. When funding is approved, the funded work plan is developed and unfunded projects are moved to a pool for consideration if and when additional funding is available. Projects proceed through development, with the ITS section providing assistance to sponsors in fulfilling funding process requirements, through project implementation and feedback (the final design and operation of the project is used to update the appropriate portions of the architecture).

The process for hybrid projects—those integrating ITS into traditional construction projects—is somewhat different, as shown in Figure 7-2. The focus of the process is to facilitate mutual information exchange to:

- encourage developers of traditional projects to take advantage of ITS elements to promote the effectiveness of the project and support overall ITS deployment objectives; and
- insure that the impacts of any project ITS elements on the broader NOVA ITS infrastructure are identified and appropriately addressed.

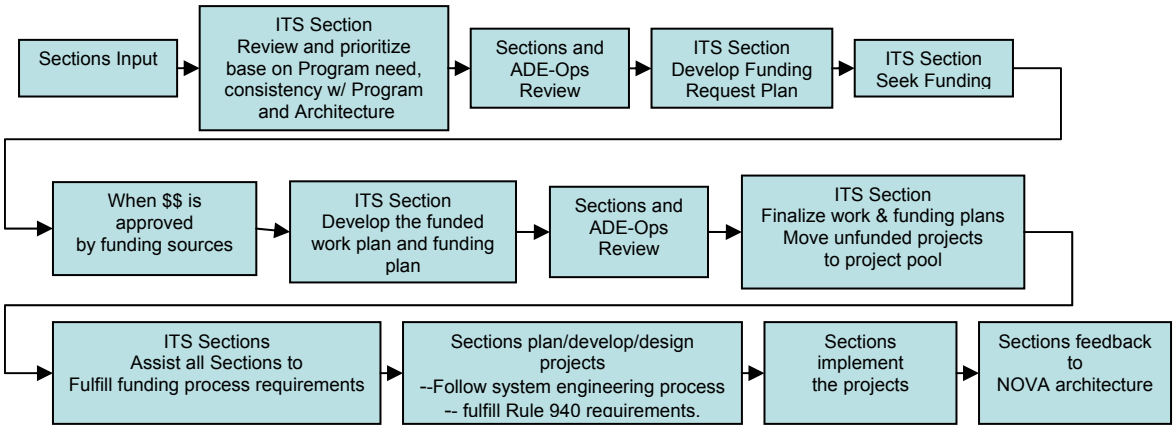

Figure 7-1. Programming and Implementation of "ITS-only" Projects

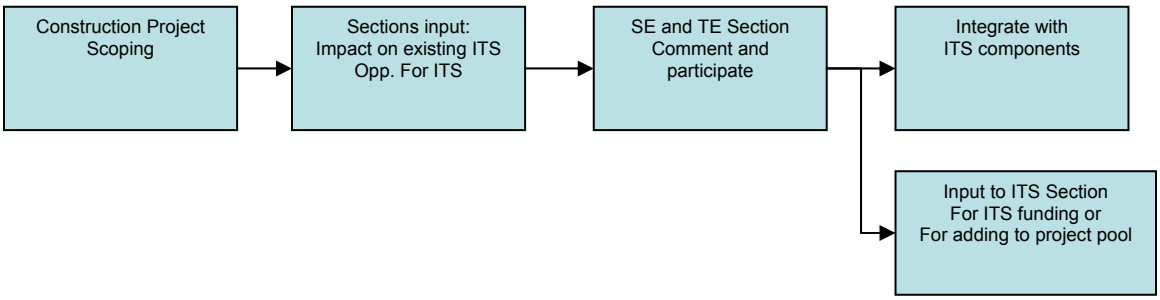

Figure 7-2. Programming and Implementation of Hybrid ITS Projects

7.4 Process for Evaluating and Prioritizing Proposed ITS Projects

Information presented in this section includes background information on sources of projects for funding consideration, an overview of the investment plan development process, and a proposed prioritization model for ITS projects.

7.4.1 Source of Projects

Proposed fiscal year ITS projects derive from the following sources:

- Existing contracts – continue funding
- From FY06 plan – continue funding
- From the unfunded project pool
- From ITS/Operations Work Plans prepared by Section Managers
- Informal input from Sections
- Expertise of ITS Section Staff

7.4.2 Investment Plan Development Process

The process for preparing the FY Investment Plan is illustrated in Figure 7-3.

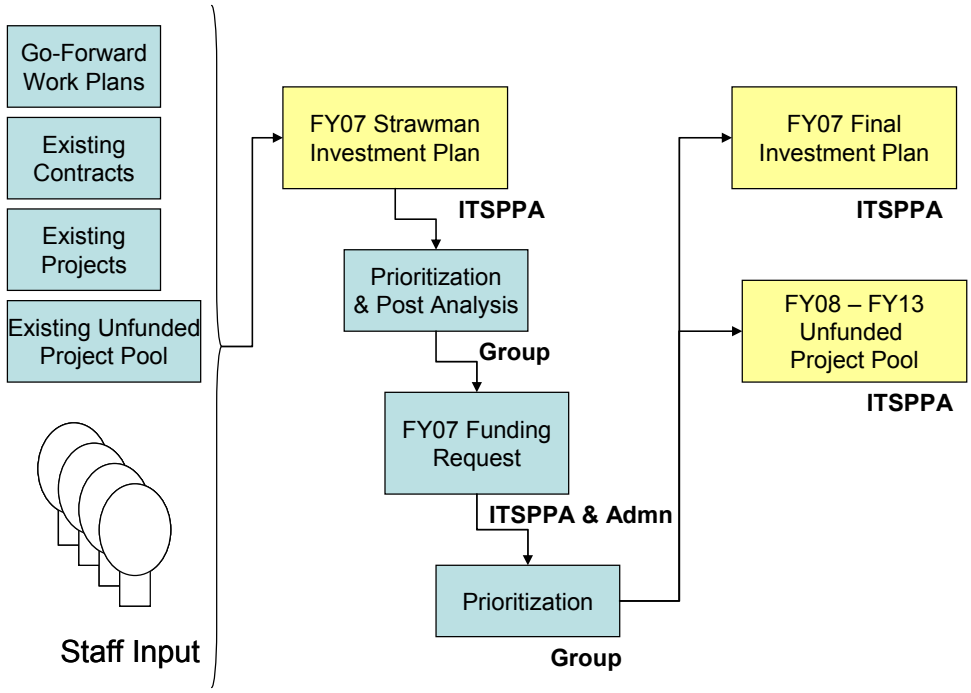

Figure 7-3. Investment Plan Development Process

Input from the sources indicated in Section 7.4.1 is the foundation of the Investment Planning Development Process. Using this input, the NOVA ITS Planning and Programming group (ITSPPA) has developed the "strawman" investment plan included in this document, covering FY07 through FY13. This strawman will be reviewed by Section Managers and revised accordingly. ITSPPA will then develop a funding request strategy (in association with the

Administration Section) and will prepare a funding request package as part of the SYIP and SPR processes. At the same time, Administration will prepare the funding request package for SYIP for state funds.

Once the District's overall funding is in place, Section Managers will discuss which projects to fund for the FY07 budget. ITSPPA will then develop Work Plans for all Sections to ensure that state and Federal processes are followed in accessing and expending the funds.

On an ongoing basis throughout the fiscal year, ITSPPA and Administration will track the progress and expenditures for all projects and will facilitate a monthly FY07 investment plan review meeting. ITSPPA will also maintain the unfunded projects pool for those projects not funded in FY07.

7.4.3 Prioritization Model

ITSPPA has developed a proposed methodology for prioritizing projects that ranks projects based on how well they support the NOVA Smart Travel Program Plan goals identified in Section 4 of this document; the value that the project itself adds to the overall NOVA Smart Travel Program; and how closely the project meshes with guiding documents such as the NOVA Operations Plan and the Regional Core Functions and Requirements.

The Prioritization Method renders a weighted-average score comprised of six evaluation factors. Projects are evaluated specifically upon whether, and to what extent, they "move the needle" on program area performance measures: poor to acceptable and acceptable to good. These measures are graphically illustrated in the same manner used by the NOVA Dashboard: red for poor performance, yellow for acceptable, green for good.

The proposed prioritization methodology is represented by the following formula:

Project prioritization score = $[\sum Xi*Yi*Zi]*C+P+O$

Where:

X = performance measure indicator or importance of the specific performance measure to the agency (1~5)

Y = performance measure goal set by the agency (1~5)

Z = project's relevance in improving specific performance measure (1~3)

C = cost factor

P = plan indicator

O = opportunity indicator

Essential to this equation are current baseline measures of performance, as expressed by variable "Y". Currently, these measures do not exist for the ITS/Operations Program Areas, therefore, this evaluation formula cannot be fully applied for FY07 planning. Beginning in FY07, performance will be analyzed and an indicator will be assigned, Y (red, yellow, or green), which

will become the baseline variable Y for application of this formula for FY08 planning. For FY07, lacking a performance measure baseline, the default value, 1, will be used for the performance measure goals (Y) in the formula.

Following is a detailed explanation of each element of the Project Prioritization Methodology.

Performance Measure Indicator (X)

The Performance Measure Indicator is a composite of industry-standard performance measures that can be applied in managing the performance of a transportation agency's operations. Included in the measure are: metrics recommended by the National Transportation Operations Coalition (NTOC) and metrics proposed in the *Go-Forward Performance Measures Technical Memorandum* that was produced by NOVA in 2005 concurrently with this Program Plan (only *outcome*-based measures from the Go-Forward document are included).

To assign Performance Measures, NOVA Operations Administration staff conducted a survey of Section Managers to collect their rankings of the individual metrics. These rankings were based on their importance to NOVA District Operations' Mission, Goals, and Objectives using the following scale:

5 – Critical

4 – High

3 – Medium

2 – Low

1 – None

The survey ranking results were compiled and are shown in Figure 7-4.

Participants were asked to rank each measure, relative to the others, on its importance to NOVA District Operations' Mission, Goals, and Objectives using the following scale:

5 – Critical 4 – High 3 – Medium 2 – Low 1 – None

Performance Measures	Response 1	Response 2	Response 3	Response 4	Response 5	Response 6	Response 7	Response 8	Response 9	Response 10	Response 11	Response 12	Mean
NTOC – Top 10 Measures													
Extent of Congestion – Spatial	4		4	3	4	4	5	4	4	5	4	5	**4.0**
Incident Duration	5		5	5	5	3	4	5	5	5	5	5	**5.0**
Non-Recurring Delay	4		5	5	3	3	4	3	5	4	3	5	**4.0**
Recurring Delay	4		5	3	4	4	4	4	5	4	2	4	**4.0**
Speed	4		4	2	3	3	3	5	3	4	4	2	**3.0**
Throughput – Person	3		4	3	4	2	4	3	3	4	3	4	**3.0**
Throughput – Vehicle	4		4	4	4	2	3	3	4	4	4	5	**4.0**
Travel Time – Link	4		5	5	3	3	3	5	3	4	3	2	**3.0**
Travel Time – Reliability	4		5	5	3	4	4	5	4	5	5	2	**4.0**
Travel Time – Trip	4		5	5	3	1	3	4	2	4	5	2	**4.0**
Go Forward PM Tech Assessment Consolidated Measures													
System-wide Congestion Monitoring - *See NTOC Measures*													
Volume Capacity Ratio	5		3	4	4	2	4	3	5	4	5	5	**4.0**
HOV / Rev Lanes / Shoulder Lanes													
HOV Occupancy Rate	4		4	2	4	2	4	5		4	5	4	**4.0**
HOV Volume	5		3	2	4	2	4	4	3	4	4	4	**4.0**
HOV Speed	5		3	2	4	2	4	3	4	5	3	4	**4.0**
HOV Travel Times	5		3	4	4	3	3	4	4	5	4	2	**4.0**
HOV Violation Rate	4		4	1	3	3	3	3	4	3	3	1	**3.0**
Percent of Vehicles using HOV that are hybrids	4		5	2	3	1	4	3	4	4	3	2	**3.0**
Mean Time Between Failure - HOV ITS Devices	4		5	4	4	3	3	4	3	4	5	5	**4.0**
Mean Time to Repair - HOV ITS Devices	4		5	5	4	3	3	4	4	4	5	5	**4.0**
Incident Duration in HOV Lanes	5		5	5	5	2	4	5	4	5	5	5	**5.0**
Air Quality Compliance													
Emissions	3		3	1	2	1	3	2	4	4	4	4	**3.0**
Fuel Consumption													
Amount of Fuel Used in Congestion Conditions	3	5	3	1	2	1	3	2	3	4	4	4	**3.0**
Safety													
Frequency of Incidents	5	5	4	4	4	3	5	4	3	5	4	5	**4.0**
Number of Incidents *													**5.0**
Number of Fatalities *	4	5	5	3	3	4	4	3	2	5	4	2	**5.0**
Incident Duration *	5	5	5	5	5	4	4	3	4	5	5	5	**5.0**
Incident Detection Time by Type	5	5	5	5	4	1	4	4	4	5	5	5	**5.0**
Incident Verification Time	5	5	5	5	5	2	4	5	4	5	5	4	**5.0**
Incident Response Time	5	5	5	5	4	2	4	5	4	5	5	5	**5.0**
Incident Clearance Time	5	5	5	5	5	2	4	5	4	5	5	5	**5.0**
Safety Service Patrols													
Number of SSP Assists	4	5	2	2	4	3	4	4	3	5	3	5	**4.0**
Type of SSP Assists	4	5	3	2	3	3	3	5	3	3	3	5	**3.0**
SSP Assist Time (Incident Duration)	5	5	5	5	5	3	4	5	3	5	5	5	**5.0**
Traveler Information													
DMS Reliability	5	5	4	4	5	4	4	5	4	5	4	5	**4.5**
DMS Message Usefulness/Relevance	5	5	4	5	5	3	4	5	4	5	3	5	**5.0**
Number of System Generated Message that are Operator Modified	3	4	1	3	3	3	5	3	3	3	3	4	**3.0**
Media Utilization of CCTV Images/STC data	3	5	2	3	4	4	4	4	5	5	3	1	**4.0**
Field Device Maintenance													
ITS Device Down Time	5	5	4	3	5	3	4	5	5	5	5	5	**5.0**
Number of ITS Devices in Failure by Type	4	5	3	3	5	4	4	3	5	4	5	5	**4.0**
Number of Routine ITS Maintenance Jobs	3	4	2	3	3	4	3	4	4	3	3	5	**3.0**
Number of Non-Routine ITS Maintenance Jobs	4	5	2	3	4	4	3	4	3	4	3	5	**4.0**
Signal Device Down Time	5	5	4	4	5	4	4	5	4	5	5	5	**5.0**
Number of Signal Devices in Failure by Type	4	5	3	4	5	4	4	3	4	5	4	5	**4.0**
Number of Routine Signal Maintenance Jobs	3	5	2	4	3	3	3	4	3	4	3	5	**3.0**
Number of Non-Routine Signal Maintenance Jobs	4	5	2	4	4	4	3	4	3	4	3	5	**4.0**
Number of Hours Lane Restricted Due to Routine Maintenance	4	4	4	4	3	1	5	3	3	5	3	5	**4.0**
Number of Hours Lane Restricted Due to Non-Routine Maintenance	4	4	4	4	4	1	5	3	4	5	3	5	**4.0**
STC System Maintenance													
Number of Devices in System by Type	4	5	2	2	2	3	3	3	4	4	3	5	**3.0**
Number of Devices Operating	5	5	5	3	4	4	4	4	4	4	5	5	**4.0**
STC System/Subsystem Software Module Failures	5	5	4	5	5	3	4	4	4	4	5	5	**4.5**
STC System/Subsystem Hardware Module Failures	5	5	4	5	5	3	4	4	4	4	5	5	**4.5**
STC System Component Down Time	5	5	4	5	5	2	4	5	4	4	5	5	**5.0**
Work Zone Management													
Number of Incidents in Work Zones *	5	5	4	4	3	5	4	3	3	4	4	5	**5.0**
Number of DOT/Contractors Injured in Work Zone	4	5	4	4	4	4	4	4	3	4	4	5	**4.0**
Congestion Due to Work Zone	3	5	5	4	4	3	5	5	4	4	4	5	**4.0**
Road Weather Management													
Number of Responses Due to Weather Detection	3	4	2	4	2	2	4	4	4	4	3	3	**3.5**
Number of Times Weather Station Saved Staff Response	3	4	2	4	2	3	3	4	4	4	4	3	**3.5**
Information Management													
Number of Requests for Data by Other Agencies	3	4	4	2	3	3	3	3	3	3	4	4	**3.0**
Number of Requests for Data by ISPs or Media	3	4	3	2	2	3	3	4	3	3	4	4	**3.0**
Requests for data for VDOT studies	3	5	3	2	2	4	3	3	4	3	4	4	**3.0**
Quality of Data	4	5	4	5	5	5	4	5	4	4	5	5	**5.0**
Customer Satisfaction													
Number of Customers Contacting VDOT Due to Complaints	5	5	5	3	2	4	4	4	4	4	5	5	**4.0**
Number of Customers Contacting VDOT Due to Appreciation	4	5	5	3	2	3	5	5	4	4	5	4	**4.0**
Average Response Time Regarding Customer Complaints	5	5	4	5	3	3	4	3	3	4	5	5	**4.0**
Type of Customer Complaints	4	5	3	3	2	4	3	3	4	4	3	5	**3.5**

* Measures denoted by an asterisk are included the VDOT-wide performance management initiative and received an automatic score of 5 - Critical Priority

Figure 7-4. Performance Measure Rankings

Performance Measure Goal Indicator (Y)

❖ Objective is to sustain or improve performance.

Moving forward, Program Areas will be evaluated and assigned a performance measure as follows:

- red = poor performance;
- yellow = acceptable performance; and
- green = good performance.

The evaluation of FY07 performance becomes the baseline for each Program Area for FY08 planning.

Variable Y in the equation will then be computed thus:

Expected FY07 Performance Measure Goal Chart:

Current Baseline Performance	Target Performance	Y
		5
		4
		3
		2
		1

Placing a premium on maintenance of acceptable performance (e.g., green-green) rather than moving from unacceptable to acceptable performance (e.g., red-yellow) is based on the asset management principle that there is a higher return for incremental investments that keep systems performing well.

Project's Relevance to Performance Measure Indicator (Z)

❖ Describes the impact the project will have on improvement of performance measure.

This indicator expresses the relevance of a specific project to meeting the performance measures included in variable Y. Variable Z measures the impact of a project on "moving the needle" of those performance measures. This variable will be scored by the NOVA District Management Team according to the following scale:

Project's relevance to improving measures is High – score: 3
Project's relevance to improving measures is Medium – score: 2
Project's relevance to improving measures is Low – score: 1

Cost Indicators (O)

- ❖ Measures relative project cost.

This variable ranks projects based upon their expected cost as shown in the FY07 Work Plan. Individual projects are placed relative to the list of all projects, so the dollar value that constitutes "low, medium, and high" will change from year to year. In the FY07 plan, the cost indicators are defined as follows:

Project cost below $xxx,xxx (to be determined) is Low – score: 3
Project cost between $xxx,xxx and $x,xxx,xxx (to be determined) is Medium – score: 2
Project cost above $x,xxx,xxx (to be determined) is High – score: 1

Plan Indicators (P)

- ❖ Assesses how relevant project is in supporting NOVA Smart Travel (ITS) Strategic Plan and NOVA Operations Plan goals.

Since each project can be mapped to the NOVA Smart Travel Program Plan and the NOVA Operations Plan, the projects' relevance to those plans should be considered. For example, a project would be considered relevant if it is compliant with the NOVA ITS Architecture. Such a project would have gone through some type of stakeholder validation process and was deemed important for the region.

Each project will be assessed based on which ITS Program Goals that project addresses. Points will be assigned for each goal, as shown below:

NOVA Smart Travel Program Goals	FY07 Priority Score
Enhance public safety	10
Enhance mobility	9
Make the transportation system user friendly	7
Enable cross-cutting activities to support goals 1-3	6

Each project will be assessed based on which NOVA Operations Plan Goals it addresses. Points will be assigned for each goal, based upon the following scale:

NOVA Operations Goals	FY07 Priority Score
Ensure safe operation of the NOVA road net	10
Move traffic efficiently on the NOVA road net	10
Detect, verify, respond and manage vehicular incidents timely and effectively	8
Communicate/coordinate road net information with regional and local jurisdictions	8
Provide meaningful and useful information to the traveling public	10

Each project will be assessed based upon its compliance with the NOVA ITS Architecture using a scale of one to five. The ITSPPA team will conduct this assessment.

Opportunity Indicators (O)

- ❖ Is project an "enabling investment?"
- ❖ Can ITS project leverage roadway construction projects?

Each project will be ranked, on a scale of one to five, on the extent to which it is an "enabling investment", that is, it supports other planned technology applications or supports other critical agency priorities.

Each project will be assessed to determine if there are other construction project opportunities that this project can leverage with, using a scale of one to five. Examples of opportunities are: existing construction projects in FY06 SYIP, draft FY07 SYIP, Earmark projects from SAFETEA-LU, PPTA, and private partners, etc.

Calculating Project Prioritization: An Example

As previously noted, the project prioritization equation is expressed as:

Project prioritization score = $[\sum Xi*Yi*Zi]*C+P+O$

Where:

X = performance measure indicator or importance of the specific performance measure to the agency (1~3)

Y = performance measure goal set by the agency (1~5)

Z = project's relevance in improving specific performance measure (1~3)

C = cost factor

P = plan indicator

O = opportunity indicator

The following example demonstrates how projects are to be scored with both indicators:

Project A can improve two performance measures: travel time and recurring delay.

Step 1 – Importance of the specific performance measure (X):

- Travel time (X_1) is a high priority measure for NOVA, it has score of 5.
- Recurring delay (X_2) is a medium priority measure for NOVA, it has score of 3.

Step 2 – Performance measure goal (Y):

Travel time baseline is yellow and the goal is to improve to green.
Recurring delay baseline is red and the goal is to improve to yellow.

According to the performance measure goal in FY07:

- Improve from yellow to green receives 4 points (Y_1).
- Improve from red to yellow receives 2 points (Y_2).

Step 3 – Project's relevance to improving measures (Z):

The "relevance" of Project A to improve travel time is High (Z_1), therefore, the score is 3 (Med = 2, Low =1).

The "relevance" of Project A to improve recurring delay is Medium (Z_2), therefore, the score is 2 (Med = 2, Low =1).

Step 4 – Project cost factor (C):

Project A's cost is medium, therefore, the score is 2 (High =1, Low =3).

Step 5 – Plan indicator (P):

- This project meets 2 NOVA Smart Travel Program goals and receives 18 points.
- This project meets 2 NOVA Operations goals and receives 20 points.
- This project is included in the architecture (entirely), receives 5 points.

This project's plan indicator = 18 + 20 + 5 = 43.

Step 6 – Opportunity indicator (O):

- This project enables measuring travel time, which is a critical state-wide measure for NOVA and receives 5 points.
- This project cannot leverage on other project opportunity, receives 0.

Therefore, the total opportunity indicator = 5

Step 7 – Final project score:

X_1=5 X_2=3
Y_1=4 X_2=2
Z_1=3 Z_2=2
C=2 P=13 O=5
Final project score = $[\sum X_i*Y_i*Z_i]*C+P+O$

= [5*4*3+3*2*2]*2+43+5 = 72*2+43+5 = 144+43+5 = 192

Step 8 – Post analysis:

After all projects are scored, the team will review and make adjustments.

7.5 Guidelines for Consideration of ITS Elements in Roadway Projects

This section presents guidelines for use by NOVA Traffic Management and Operations Program Managers for considering whether, and how, ITS elements may be appropriate to include in highway projects. The guidance is intended to support decisions related to the integration of ITS initiatives into both short-term and long-term projects and the review of existing projects for opportunities to integrate ITS elements. The core of the guidance consists of a form and a series of steps to be utilized by the project manager.

7.5.1 ITS Consideration Form

Figure 7-5 presents the ITS Consideration Form. The form is a useful tool that can be extracted from this document and utilized on each project for evaluating ITS elements. The form provides a guided list of considerations for evaluating the ITS needs of an individual project. The form provides direction in the form of a series of questions to project managers with limited knowledge of ITS elements in what should be considered on each individual project to ensure ITS maintenance and expansion is taking place in a cost-effective manner. It also provides a guided approach to involving personnel responsible for ITS maintenance and expansion into roadway and maintenance projects in a timely manner to ensure no device or expansion opportunity goes unnoticed.

Incorporating ITS efforts into existing and proposed construction and maintenance projects is a cost-effective approach to incorporating advanced traffic management elements into the transportation system. Incorporating the devices and elements that enhance the intelligence of the transportation system into ongoing projects reduces the disruption to transportation system users, provides information in a timely manner, and improves the overall system.

The ITS Consideration Form, Figure 7-5, is intended to be copied and utilized on existing and planned projects on an on-going basis as a guide to increase awareness of ITS initiatives and involve all the affected departments of the agency in the successful completion of projects.

Project Description

Project Title: _____

Project Limits: _____

Project Manager: _____ **Date:** _____

Section 1: General ITS Element/Device Status

A. Are there currently any ITS devices or elements located within the limits of this project?

☐ **Yes** — **Check all elements/devices below and proceed to Section 2.**

☐	Closed-circuit Television (CCTV)	☐	Variable Message Signs (VMS)
☐	Condition Monitoring/Incident Detection (CMS/IDS)	☐	Gate Control System (GCS)
☐	Lane Control Signals (LCS)	☐	Ramp Metering System (RMS)
☐	Vehicle Classification System (VCS)	☐	Truck Rollover System
☐	Highway Advisory Radio System (HAR)	☐	Road Weather Information System (RWIS)
☐	Smart Traffic Signal System (STSS)	☐	Rosslyn Tunnel Control System
☐	Call Box System	☐	Storm Sentry System
☐	Woodrow Wilson Bridge Sign System	☐	Other _____
☐	Other _____		
☐	Other _____		

☐ **No** — **If no, skip Section 2 and proceed to Section 3**

Figure 7-5. ITS Consideration Form

Section 2: Existing ITS Devices/Elements

A. Device/Element #1 Description: _____

Department to coordinate effort with: _____

Contact from department: _____

1. Is the device currently functioning properly?

☐ **Yes** ☐ **No**

2. Is the device at the end of its lifecycle or will it be by the time this project is complete?

☐ **Yes** ☐ **No**

3. Does the device still provide a valuable function?

☐ **Yes** ☐ **No**

4. Has new technology been adopted that replaces/upgrades this device?

☐ **Yes** ☐ **No**

B. Device/Element #2 Description: _____

Department to coordinate effort with: _____

Contact from department: _____

1. Is the device currently functioning properly?

☐ **Yes** ☐ **No**

2. Is the device at the end of its lifecycle or will it be by the time this project is complete?

☐ **Yes** ☐ **No**

3. Does the device still provide a valuable function?

☐ **Yes** ☐ **No**

4. Has new technology been adopted that replaces/upgrades this device?

☐ **Yes** ☐ **No**

C. Device/Element #3 Description: _____

Department to coordinate effort with: _____

Contact from department: _____

1. Is the device currently functioning properly?

☐ Yes ☐ No

2. Is the device at the end of its lifecycle or will it be by the time this project is complete?

☐ Yes ☐ No

3. Does the device still provide a valuable function?

☐ Yes ☐ No

4. Has new technology been adopted that replaces/upgrades this device?

☐ Yes ☐ No

D. Device/Element #4 Description: _____

Department to coordinate effort with: _____

Contact from department: _____

1. Is the device currently functioning properly?

☐ Yes ☐ No

2. Is the device at the end of its lifecycle or will it be by the time this project is complete?

☐ Yes ☐ No

3. Does the device still provide a valuable function?

☐ Yes ☐ No

4. Has new technology been adopted that replaces/upgrades this device?

☐ Yes ☐ No

Section 3: New ITS Devices/Elements
A. Are there plans currently in place to expand ITS elements into the region covered by this project?
☐ **Yes** ☐ **No**
Comments: _____
_____
B. Does the need exist to expand current ITS services into the area covered by this project?
☐ **Yes** ☐ **No**
Comments: _____
_____
C. Are there problems or issues that could be solved or improved by expanding ITS elements into this area?
☐ **Yes** ☐ **No**
Comments: _____
_____

Comments:

7.5.2 ITS Elements to Be Considered

There are many different elements that encompass ITS. These elements provide information both to system operators as well as motorists using the transportation system. Each of these elements is integral to the system and provides a unique value. This section provides brief descriptions of ITS elements and their functions.

- Closed-circuit Television – CCTV provides real-time camera images of what is occurring on the transportation system. CCTV is typically equipped with pan-tilt-zoom capabilities to allow camera operators to adjust the view of the camera to observe occurrences throughout an extended region. The operator can utilize the cameras to detect and verify incidents, verify the functionality of other field devices and provide traffic information.
- Variable Message Signs – VMS are changeable, electronic roadside displays that provide real-time information to motorists. The information is site-specific and provides information on roadway conditions the motorist is approaching. This allows motorists to make route decisions based on the most up to date information available and reduces congestion and delay.
- Condition Monitoring System and Incident Detection System (CMS/IDS) – CMS/IDS provides for data collection as related to traffic operating conditions – speed, travel time, volume and occupancy data. This information is collected utilizing a range of technologies including inductive loops, radar sensors, electronic toll collection techniques, video detection. Additionally, this data can also be provided by private sources rather than agency-owned equipment.
- Gate Control System (GCS) – The GCS provides access control to reversible HOV lanes. This system works in conjunction with the VMS to provide information related to the operation of the reversible HOV lanes.
- Lane Control Signals (LCS) – LCSs are overhead dynamic signs that provide information to motorists to indicate when a lane is open or closed to traffic.
- Ramp Metering System (RMS) – RMS utilizes traffic signals on freeway on-ramps to control the rate of traffic entering the freeway system. This system is utilized to prevent, delay, or reduce congestion by preventing over saturation on the mainline.
- Vehicle Classification System (VCS) – The VCS utilizes piezoelectric detectors along interstates to count axles of vehicles passing over. These detectors provide information on the percentage of trucks as part of the overall traffic volume.
- Truck Rollover System – This system is used to deliver a "Sharp Curve – Slow Down" message to truck drivers in advance of reduced-speed curves along the freeway system. The system monitors the height and speed of oncoming trucks and determines if the vehicle is approaching at an unsafe speed. If this is the case, it will alert the driver with flashing lights and a sign message.

- Highway Advisory Radio System – This system is used to provide confirmed incident, roadwork and congestion information to the general public via radio. The HAR system will be utilized in the future for construction and maintenance activities. Incident information dissemination will be provided by other technologies listed below.
- Road Weather Information System – This system is not currently in place, but implementation of a system would provide information on pavement and weather conditions to maintenance and operations personnel and travelers through the use of sensors embedded in or adjacent to the pavement. Pavement sensors can monitor temperature, freeze point, moisture, form of moisture (rain/snow/ice) and amount of deicing chemical present. Atmospheric sensors measure air temperature, relative humidity, wind speed and direction, precipitation type, intensity and rate and visibility.
- Rosslyn Tunnel Control System – This system consists of fans, lights, and communications infrastructure within the Rosslyn Tunnel located along I-66 in Arlington. The system provides ventilation and lighting to ensure safe travel of vehicles through the facility.
- Smart Traffic Signal System – This system includes roughly 1,200 signalized intersections that NOVA maintains and operates. The system allows operators to monitor signal status, collect traffic flow data, and make remote adjustments to signal timings.

7.5.3 ITS Elements Not to Be Considered

This section identifies ITS elements that have come to the end of their useful life or have been replaced by improved technologies.

- Call Box System – The Call Box System is a series of telephones on the Dulles Toll Road that directly connect to the Smart Traffic Center. The call boxes are provided as an aid to the public to report incidents and emergencies. These devices are being phased out as they fail. The overwhelming presence of cell phones in use today has made this technology obsolete.
- Storm Sentry System – This is a weather radar alert system which was a subscription service. The term of this service has ended and NOVA has discontinued this program.
- Woodrow Wilson Bridge Sign System – This system is at the end of its useful life and existing InfoCity signs should be replaced with VMS signs to be fully integrated into the ATMS system.

8 LIST OF ACRONYMS

ADMS	Archived Data Management System
AHQ	Area Headquarters
AVL	Automated Vehicle Location
CAD	Computer-aided Dispatch
CapCOM	Capital Region Communications and Coordination
CapWIN	Capital Wireless Integrated Network
CATT	Center for Advanced Transportation Technology
CCTV	Closed-circuit Television
CHART	Coordinated Highway Action Response Team
CMAQ	Congestion Mitigation and Air Quality
CMS	Condition Monitoring System
COG	Council of Governments
CSC	Customer Service Center
CVISN	Commercial Vehicle Information System Network
DMV	Department of Motor Vehicles
DOT	Department of Transportation
DTR	Dulles Toll Road
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FY	Fiscal Year
GCS	Gate Control System
GIS	Geographical Information System
GW	George Washington
HAR	Highway Advisory Radio
Hazmat	Hazardous Materials
HOV	High Occupancy Vehicle
IDS	Incident Detection System
IEN	Information Exchange Network
IMC	Inspection, Maintenance, and Construction
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
ITSPPA	Intelligent Transportation Systems Planning and Programming Administration
IVR	Integrated Voice Response

LIST OF ACRONYMS (CONTINUED)

LCS	Lane Control System
LED	Light Emitting Diode
MCO	Maintenance and Construction Operations
MDSHA	Maryland State Highway Administration
M&O/ITS	Management & Operations/ITS
MWAA	Metropolitan Washington Airport Authority
MWCOG	Metropolitan Washington Council of Governments
NCRIP	National Capitol Region Interoperability Program
NHS	National Highway System
NOVA	Virginia Department of Transportation Northern Virginia District
NPS	National Park Service
NTOC	National Transportation Operations Coalition
NVSTC	Northern Virginia Smart Traffic Center
PBF	P.B. Farradyne
PSTOC	Public Safety and Transportation Operations Center
RECPSM	Regional Emergency Coordination Plan
RITIS	Regional Integrated Transportation Information System
RMS	Ramp Metering System
RWIS	Road Weather Information System
SOC	State-wide Operations Center
SSP	Safety Service Patrol
STC	Smart Traffic Center
STL	Smart Travel Lab
STP	Surface Transportation Program
STSS	Smart Traffic Signal System
TEOC	Transportation Emergency Operations Center
TMC	Traffic Management Center
TOC	Traffic Operations Center
TPB	Transportation Planning Board
USDOT	United States Department of Transportation
UVA	University of Virginia

LIST OF ACRONYMS (CONTINUED)

VCS	Vehicle Classification System
VDOT	Virginia Department of Transportation
VII	Vehicle Infrastructure Integration
VMS	Variable Message Sign
VOIS	Virginia Operations Information System
VRE	Virginia Railway Express
VRRP	Virtual Router Redundancy Protocol
VSP	Virginia State Police
VTTI	Virginia Tech Transportation Institute
WMATA	Washington Metropolitan Area Transit Authority