Virginia Department of Transportation

Northern Region Operations (NRO)

Strategic Plan

November 2008

Acknowledgements

This Strategic Plan was prepared by Battelle and Kimley-Horn & Associates under the direction of Mr. James Witherspoon of the Virginia Department of Transportation and the members of the project Steering Committee. Mr. Witherspoon and his consultant team thank the members of the Steering Committee for their contributions:

NRO Regional Operations Directorate
Richard Steeg

NRO Business Administration
Monica Bhatia
John Lindquist

NRO Planning and Programming
Amy Tang McElwain
J.D. Schneeberger

NRO Traffic Engineering
Kamal Suliman

NRO Traffic Operations Management
Ling Li
Nhan Vu

Virginia Department of Rail and Public Transportation
Mike Harris

VDOT Central Office
Mena Lockwood
Chris Francis

VDOT Northern Virginia District, Transportation Planning
Cina Dabestani

Table of Contents

TABLES

FIGURES

APPENDICES

Acronym List

AASHTO	American Association of State Highway Transportation Officials
ADMS	Archived Data Management System
AHQ	Area Headquarters
ATMS	Advanced Transportation Management System
CAD	Computer Aided Dispatch
CapWIN	Capital Wireless Information Network
CCTV	Closed-Circuit Television
DDOT	District (of Columbia) Department of Transportation
DMS	Dynamic Message Signs
DTR	Dulles Toll Road
DYNASMART-P	Dynamic Network Assignment-Simulation Model for Advanced Roadway Telematics - Planning
EOC	Emergency Operations Centers
FY	Fiscal Year
HAR	Highway Advisory Radio
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
ICM	Integrated Corridor Management
ICS	Incident Command System
IDAS	ITS Development Analysis System
IMC	Inspection, Maintenance, and Construction
IMMS	Integrated Maintenance Management System
ISP	Information Service Provider
ITS	Intelligent Transportation Systems
MATOC	Metropolitan Area Transportation Operations Coordination
MOITS	Metropolitan Intelligent Transportation Systems Planning Group
MPSTOC	McConnell Public Safety and Transportation Operations Center
MWAA	Metropolitan Washington Airports Authority
MWCOG	Metropolitan Washington Council of Governments
NoVA	Northern Virginia
NRO	Northern Region Operations
NROPP	Northern Region Operations Planning and Programming
RITA	Research and Innovative Technology Administration
RITIS	Regional Integrated Transportation Information System
RWIS	Road Weather Information System

SE	Systems Engineering
SOPP	System Operations Program Plan
SORAC	System Operations Research Advisory Committee
SSP	Safety Service Patrol
SWAM	Small, Women or Minority Owned
TDM	Travel Demand Management
TE	Traffic Engineering
TEOC	Transportation Emergency Operations Center
TMP	Transportation Management Plan
TO	Traffic Operations
TOC	Transportation Operations Center
UPS	Uninterruptible Power Supply
USDOT	United States Department of Transportation
VDOT	Virginia Department of Transportation
VIDS	Video Incident Detection Systems
VII	Vehicle Infrastructure Integration
VRE	Virginia Railway Express
VSP	Virginia State Police
WMATA	Washington Metropolitan Area Transit Authority
WRTM	Weather Responsive Traffic Management

Director's Message

We are in trying and uncertain times regarding our organization, our program, and our funding. At the same time, we are committed to deliver our operations program with clear focus, direction, and urgency… And we will. From tough times and adversity springs opportunity for those willing. I know without doubt that I can count on each of you to do your part. I know that we will deliver a successful operations program. It is true that change is all around us, uncertainty too, and we all have to adjust. Now more than ever, it is important to have a crystal clear focus on what we do, how we do it, why, and when.

This Strategic Plan lays the foundation for our success. It has been developed to endure time, to be flexible in the face of change, and to keep us focused on providing safety, mobility, reliability, and timely information for the highways and roads in Northern Virginia.

We will revisit the goals, objectives, and strategies on an annual basis. Some will be added, others deleted, and others reprioritized, but the mission will remain the same. Please take the time to read this document as it will guide us in the short and long term.

Thank you for your unending commitment to the organization, and above all our customers.

Richard W. "Dick" Steeg, P.E.
Northern Region Operations Director

I. Executive Summary

This Strategic Plan charts the direction for the Virginia Department of Transportation Northern Region Operations (NRO) Directorate. It identifies the needs that motivate us, what we aim to accomplish, how we will do it, and how we will measure and report our progress. Relative priorities for any given fiscal year will continue to be determined through the annual planning and programming process, taking into account the overall strategic direction established in this plan.

1.1 What Do We Want to Accomplish?

VDOT NRO's **Vision** is to ***make roadway travel safe, efficient, and reliable.***

Our **Mission** is to:

- Serve the public by providing them with the information they need to make good travel decisions, including using multiple travel modes, and by responding quickly and effectively to their questions and concerns
- Monitor real-time traffic conditions and the condition of our infrastructure throughout the system
- Proactively and rapidly identify problems, including traffic congestion, crashes and other incidents and infrastructure maintenance needs
- Take rapid and effective action to address current and developing problems, appropriately applying a range of methods including physical improvements, traffic signal strategies, incident and emergency management strategies, enhanced maintenance, and various advanced technology strategies
- Share information, coordinate responses, and plan jointly with our partner organizations.

Our activities are driven by nine goals, organized into three categories: "Transforming the System," "The Way We Do Business," and "Reshaping/Redeveloping the Workforce." Our activities are further directed by 25 specific **Objectives**, each linked to one of the nine goals.

Goals and Objectives	
Transforming the System	
1. Reduce Congestion	a. Reduce travel times and delays for all modes along identified major corridors
	b. Improve travel time reliability on major corridors
	c. Actively manage travel demand on NRO facilities
	d. Reduce delays due to work-zones and planned special events
	e. Reduce incident clearance times
2. Improve Safety	a. Reduce vehicular crashes
	b. Reduce pedestrian and bicyclist crashes

Goals and Objectives	
Transforming the System	
3. Enhance Communication with Travelers	a. Provide proactive, timely, and accurate information and responses to the traveling public.
4. Promote Environmental Responsibility	a. Reduce energy consumption and environmental costs of transport operations
5. Preserve and Manage an Integrated Traffic Management System	a. Maintain field infrastructure so that it operates reliably
	b. Improve information gathering on freeways and arterials
6. Improve Emergency Management	a. Enhance coordination of regional emergency management
	b. Reduce NRO critical asset vulnerability
The Way We Do Business	
7. Improve the NRO Business Process	a. Optimize operations planning, programming and project delivery time
	b. Make the rationale for all NRO investments clear and consistent
	c. Make performance-based decisions
	d. Utilize equal employment opportunity practices in hiring and procurement decisions
	e. Minimize project cost and schedule overruns
8. Improve Regional Operations Coordination and Efficiency	a. Encourage application of technology-based operations solutions in all relevant construction projects
	b. Improve operations planning with regional operations partners
	c. Improve day to day information exchange with regional operations partners
Reshaping/Redeveloping the Workforce	
9. Enhance and Develop NRO Workforce Capabilities	a. Enhance workforce needs planning to prepare for the future operations
	b. Support and sustain a learning environment for NRO staff
	c. Attract and retain a diverse talented workforce
	d. Reduce workplace accidents

Table 1.1 – Goals and Objectives

1.2 How Will We Measure Our Progress?

The ability to measure our progress in achieving our objectives is critical, both as an internal management tool and also as a way to be accountable to the public. We will use 25 **objective tracking measures** to assess our progress toward our goals and objectives

In addition to the tracking measures, which are intended for internal use, we will communicate our performance to the general public in the following four key areas using these 5 measures:

- Safety
  1. Total number of crashes on the NRO system
  2. Number of fatalities on the NRO system

- Mobility
  3. Percentage of Interstate vehicle miles traveled at “good” level of service
- Customer Service
  4. Overall satisfaction with VDOT NRO
- Project Delivery
  5. Percentage of projects completed on-time and within-budget

1.3 What Strategies Will We Utilize?

The strategies we will use to meet our goals and objectives are organized into the following 11 **Program Areas**:

1. Traveler Information
2. Corridor/Congestion Management
3. Emergency Management
4. Incident Management
5. Road-Weather Management
6. Safety and Incident Prevention
7. Regional and Statewide Coordination
8. Construction and Work Zone Management
9. Data Management
10. Asset Management
11. Enabling Activities

We believe in aiming high and that our reach should exceed our grasp. But we also understand that resource constraints play a major role in defining what we can accomplish. Therefore, the approximately 70 **Strategies** we have identified in the 11 Program Areas include those that expand the reach and scale of our activities as well as those that strengthen, renew, and reinvest in our core capabilities.

Many of the strategies focus on better **maintaining, upgrading, optimizing or expanding the coverage of our core tools**—the “eyes and ears” that provide the foundational, real-time information we need to anticipate and recognize problems as well as our most direct means of communicating with travelers on NRO facilities. Strategies in this area include upgrading and expanding:

- Dynamic message signs (DMS)
- Closed-circuit television (CCTV) cameras
- Advanced Transportation Management System (“ATMS”—the central control software)
- Telecommunications Infrastructure
- Portable CCTV cameras and highway advisory radio (HAR) systems for work zones
- Vehicle detectors

- Safety Service Patrols (SSP)
- The road-weather information network.

Many of the strategies focus on **taking our operational strategies and services "to the next level"** of sophistication, integration, coordination and effectiveness. Strategies in this area include:

- "Integrated Corridor Management" which focuses on using the full array of tools, modes (highway and transit) and facilities (freeways and arterial streets) to manage travel in targeted corridors
- "Next generation" traffic signal equipment and operational strategies
- Enhanced traveler and public information, including travel times, park-and-ride lot information, traffic queue and disabled vehicle warnings, and a NRO "dashboard" summarizing our performance
- Implementing VDOT Commissioner David Ekern's plan for improving emergency response through "weather-responsive traffic management," regional evacuation route management, and National Incident Management System command and control strategies
- Continue integration of the VDOT Northern Region Operations ATMS with law enforcement and emergency responder computer-aided dispatch systems to improve incident detection
- Increase data sharing between VDOT NRO and statewide systems such as VA-Traffic
- Transitioning to the McConnell Public Safety and Transportation Operations Center (MPSTOC), which features co-location of NRO personnel with Virginia State Police and Fairfax County public safety personnel
- "Active Traffic Management" which focuses on trip reliability and maximization of the effectiveness and efficiency of roadways through a holistic package of tools and strategies that may include: dynamic ramp metering, speed harmonization, temporary shoulder use, junction control, and dynamic signing and rerouting
- Continue and enhance our participation in planning and implementation of regional operations-related initiatives such as development of the Washington Region Metropolitan Area Transportation Operations Coordination (MATOC) Program and participation in regional, multi-modal traveler information.

Finally, a number of strategies focus on **doing our jobs efficiently and effectively**, including investments in the most critical component of our systems: **our personnel**. Strategies in this area include:

- Continued movement toward a pervasive, objectives-driven, performance-based approach to meeting transportation needs, including setting specific performance targets, incorporating estimated project benefits into

programming decisions, and tracking the performance of projects once deployed

- Training our personnel on best practices for managing operations projects and contracts
- Participating in district and state internships and associates programs
- Enhancing training on safety procedures
- Conducting an internal survey of employees.

1.4 Moving Forward

If operations are now a core, prominent VDOT and NRO activity—as indeed they are—then this Strategic Plan is the very center of that core. But plans that sit on shelves do little good. To leverage the investment made in this Strategic Plan—to put it to work—it will need to become a primary input and guiding influence in the annual planning, programming and project delivery process. Additionally, each of us, in carrying out our daily duties needs to ask:

- How will this project/activity help us achieve the goals and objectives in this Strategic Plan?
- Does this project/activity advance, or is it consistent with, one or more of the strategies identified in the Strategic Plan?

II. Introduction

2.1 Purpose and Overview

This document presents the strategic plan for the Virginia Department of Transportation (VDOT) Northern Region Operations (NRO) Directorate. The strategic plan establishes overall direction by identifying all of the needs, goals, and objectives that NRO seeks to address in the foreseeable future, as well as the strategies that will be used to address them. The plan does not identify priorities. Decisions about which of the needs, goals, objectives, and strategies will be a priority for a given year are made through the annual planning and programming process. This approach allows NRO to adapt dynamically to funding availability, opportunities, and other factors that change annually while maintaining an overall strategic direction established by this plan. Adjustments to this strategic plan will be considered on an on-going basis and the plan will be formerly revised periodically.

This plan builds upon and incorporates the many operations activities that have been carried out for many years. It also updates the direction identified in previous strategic plans, including the most recent, the *VDOT Northern Virginia (NoVA) Smart Travel Program Plan,* prepared in 2006. In addition to revisiting and updating key elements like needs, goals and objectives, and strategies, this plan expands the coverage area to include the VDOT Fredericksburg District (prior plans covered only the NoVA District).

In some places in this report the phrase “Intelligent Transportation Systems” or “ITS” appears. That terminology refers to the application of a wide array of advanced technologies within surface transportation operations. Increasingly, the United States Department of Transportation (USDOT) and other state and local transportation agencies are dropping “ITS” in favor of the more comprehensive term “transportation systems management and operations,” or simply “operations” which encompasses all aspects of operations, including those which feature advanced technologies. This report utilizes the term “operations” except when referencing existing programs, projects or systems that continue to utilize the “ITS” label, such as the USDOT “ITS Standards Program.”

This plan contains the following elements:

- A description of NRO and the role of this plan
- Overall NRO strategic direction, defined by:
  - Needs to be addressed
  - A strategic vision toward which to strive
  - A strategic mission to carry out
  - Goals and objectives to be accomplished
  - Measures to evaluate progress toward accomplishment of goals and objectives

- A strategic program plan containing 11 Program Areas, each identifying the strategies to be utilized by NRO
- A discussion of "future directions" including factors that will influence NRO direction in coming years
- A summary of the NRO planning and programming process and how this plan relates to it
- Where to go for additional information.

2.2 Relationship to Other Plans and Activities

This strategic plan was informed by, and resides within a broader context that includes, other NRO, regional, and statewide operations-related plans and activities. These other plans and activities are summarized in Table 2.1.

Related Plans and Activities	
Northern Region Operations	
ITS Architecture	Details the interconnections and flow of information among VDOT NoVA District facilities and stakeholders, including non-VDOT partner agencies. *This Strategic Plan identifies NRO direction and tools and the architecture provides a framework for implementing systems in an effective, interconnected fashion.*
Annual Prioritization Plan	Identifies and prioritizes the specific NRO projects to be funded in the upcoming fiscal year. *The inclusion of a proposed project within this Strategic Plan and the project's relationship to the goals and objectives in this plan are among the criteria considered in the prioritization process*
Regional	
Metropolitan Washington Council of Governments (MWCOG) Regional System Architecture	Details the interconnections and flow of information among Metropolitan Washington area transportation systems and stakeholders, including linkages to NRO.
Metropolitan Intelligent Transportation Systems Planning Group (MOITS)	NRO participates in these regional, multi-agency operations-related coordination efforts and systems. These regional activities were taken into consideration when developing this NRO Strategic Plan. *This NRO Strategic Plan will help other organizations in the region understand NRO goals, objectives, and strategies, thus providing a sound basis for continued and enhanced coordination.*
Washington Region Metropolitan Area Transportation Operations Coordination (MATOC) Program	
Capital Wireless Information Net (CapWIN)	
Washington, DC 511 Traveler Information System	
National Capital Regional Interoperability Group	

VDOT Statewide	
Long Range Intelligent Transportation Systems Plan	The plan is currently in draft form and will be finalized by December 2008. Organized by geography/roadway type, time frame, (1-2 years; 3-7 years; 8-12 years), and functional area (Safety, Mobility, Security and Support). Within each functional area, program areas or components are identified that will further define the strategies for operations. One focus is on guiding the development of regional operations plans, including planning tools to help identify projects and analysis tools to evaluate alternatives and prioritize projects. *When complete, this plan will help guide how this NRO Strategic Plan is carried out and it will guide future updates.*
System Operations Program Plan (SOPP)	The SOPP is currently in development and will be finalized by December 2008. The SOPP will identify the process and the program areas for system operations statewide. NRO has been a source of input into the SOPP and the SOPP will reflect the needs of NRO and the NRO strategic direction. *When complete, this plan will help guide how this NRO Strategic Plan is carried out and it will guide future updates.*
Statewide Traveler Information Strategic Plan	The statewide strategic plan for traveler information is currently being developed. *This plan will guide strategies under the NRO traveler information program area.*
Emergency Response Action Plan	In response to recent weather events, VDOT has revamped their emergency response plan with specific action items to be implemented across the entire state. *This plan played a major role in shaping the portions of this NRO Strategic Plan associated with emergency management.*
Six Year Improvement Program	A key focus within the VDOT traditional planning area, this plan contains projects that have been through a rigorous prioritization and funding approval process. Projects prioritized through the NRO annual prioritization process are submitted for inclusion in the statewide Six Year Improvement Program.
ITS Architecture	VDOT is developing a statewide architecture for ITS and is expected to be completed in early 2009. The statewide architecture defines linkages between NRO systems and statewide systems. *The architecture will also guide NRO ITS architecture updates and future development.*

Table 2.1 – Related Plans and Activities

III. Overview of Northern Region Operations

NRO was established in 2006 when VDOT consolidated the roadway operations divisions from the Commonwealth's nine transportation districts into five Regional Operations Directorates. The regional structure was based on an integrated approach to operations management and considered the system's geography, operating environment, roadway network, and customer/stakeholder base. NRO included all of the NoVA District and parts of the Fredericksburg and Culpeper Districts. With the reorganization, NRO is tasked with operating one of the busiest surface transportation networks in the country[1]. The shift to an operations culture represented a transition from traditional transportation management—which focused primarily on construction and maintenance—to one that included roadway operations as a critical component to enhance mobility, increase safety and security, and improve highway operational performance.

Since its establishment just two years ago, NRO has been committed to developing and institutionalizing a strategic approach to operations. NRO went through several changes this past year embracing both geographic and technological changes. In technology, NRO moved forward with the planning, design, development, and implementation of a new Advanced Transportation Management System (ATMS) Central Software Platform to replace the ASSIST (circa 1985) System. This change, when implemented, will significantly improve the ability of NRO to manage traffic and to respond to incidents as they occur.

From a geographic standpoint, NRO expanded from a NoVA District-based entity to a regional entity serving the NoVA District and parts of the Fredericksburg District. The geographical scope of NRO now includes owned and operated facilities located within the 7-county region depicted in Figure 3.1. As shown in Table 3.1, the operations boundary includes the cities of Alexandria, Fairfax, Falls Church, Fredericksburg, Manassas, and Manassas Park as well as 14 towns in the region.

Northern Region Operations Boundary		
Major Jurisdictions	**Local Jurisdictions**	
7 Counties	**6 Cities**	**14 Towns**
Arlington Fairfax King George Loudoun Prince William Spotsylvania Stafford	Alexandria Fairfax Falls Church Fredericksburg Manassas Manassas Park	Clifton, Middleburg, Occoquan, Dumfries, Purcellville, Hamilton, Quantico, Haymarket Herndon, Round Hill, Hillsboro, Leesburg, Vienna, Lovettsville

Table 3.1 – Northern Region Operations Boundary

[1] . The recently released National Traffic Scorecard (Inrix, 2008) ranked the Washington D.C metropolitan area #4 in the list of the top 100 most congested metros.

NRO operates the freeways and primary roadways and operates traffic signals throughout the region. The major interstates that are included in the region include:

- Interstate 66 (I-66) (within the boundaries of the VDOT Northern Virginia District)
- Interstate 395 (I-395/I-95) from DC to I-495
- Interstate 95 from I-495 through Caroline County
- All of I-495 within Virginia

3.1 NRO Organizational Structure and Functions

The current organizational structure of the NRO consists of seven sections. These seven sections report directly to the regional operations director of NRO. Figure 3.2 illustrates the current organization chart for the NRO.

Figure 3.1 – VDOT Northern Region Operations Map

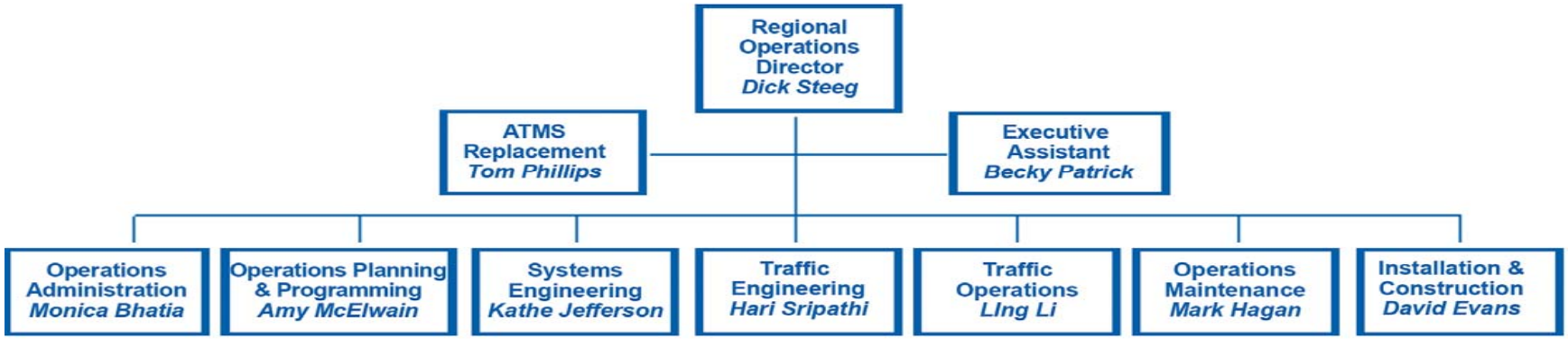

Figure 3.2 – NRO Organizational Chart

Operations Administration – Responsible for the development, implementation and monitoring the business planning for the NRO. This section also conducts performance management and oversight for key metrics and performs trend analysis and assessment of the specific measures. Additional activities include contract administration and management clearinghouse, 604 budgeting, and the back-office oversight for accounts receivable, and payable.

Operations Planning and Programming (OPP) – Responsible for planning, advocating, and facilitating the development of an integrated Transportation Operations System. In the planning area, activities include strategic planning, operations technology deployment master planning, system engineering process facilitation, architecture / Rule 940 oversight, regional coordination, and project development. In the programming area, activities include fiscal needs assessment, funding identification, requests and advocacy, annual investment planning, etc. This section is also actively involved in developing comprehensive strategies for multiple system master plans, and coordinating traffic management efforts in the region.

Systems Engineering (SE) – Works closely with the planning and programming section and the traffic engineering section. Major responsibilities include technology-related operations engineering analysis and project development, traffic engineering coordination and interfaces along with annual project pool budgeting, and assessment.

Traffic Engineering (TE) – Responsible for providing traditional traffic engineering services to internal and external customers for enhancing safety, capacity, and network simulation on the NRO operated roadways. This section is also responsible for customer service, assessment studies, signal engineering coordination, constructability review, data collection, and strategic improvement / corridor studies.

Traffic Operations (TO) – Responsible for the operations of the Smart Traffic Center and to facilitate the safe and effective flow of traffic through the NRO. Specific activities include emergency coordination and incident management, traffic management, traveler information, work zone management, freeway and arterial operations, signal operations, roadway flow assessment, and providing IT/network support to operations system.

Operations Maintenance – Responsible for sign maintenance, pavement markings, lighting, signal maintenance, asset maintenance, and telecomm maintenance for the NRO operated freeways and arterials.

Installation and Construction – Responsible for the installation and construction of operations technology systems on freeway and arterial devices, traffic signals, telecommunications, and highway lighting. Additionally, this section also provides constructability and maintainability review of the NRO operated roadways.

All these sections have specific activities and section personnel have defined roles and responsibilities for their day-to-day operations. However, there are multiple interactions within these groups that happen, in some cases on a daily basis, to ensure smooth flow of operations within NRO. Figure 3.3 depicts some of the interactions among these different groups along with some of the key inputs/outputs they produce and document as part of their daily and annual operations for NRO.

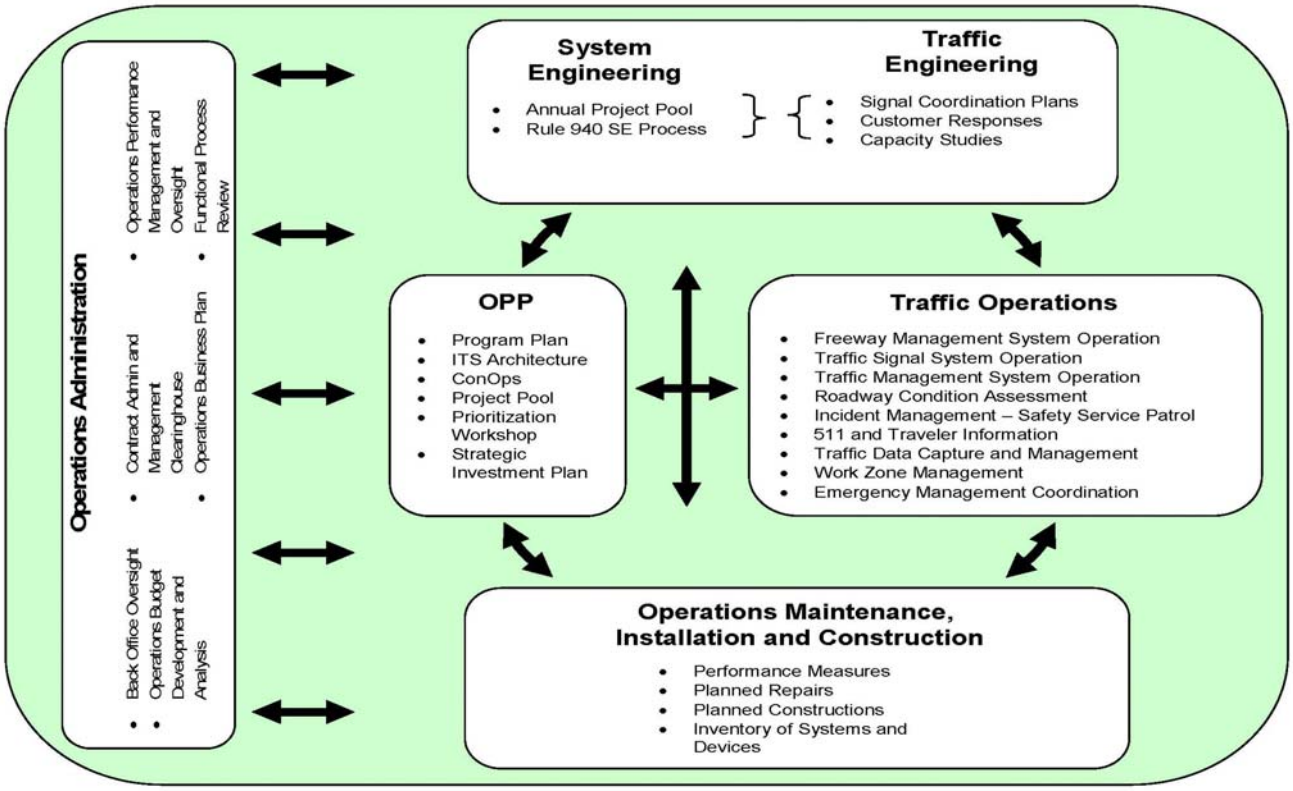

Figure 3.3 – NRO Sections and Interactions

3.2 NRO Partners

NRO operates in a multi-stakeholder environment with multiple jurisdictional and institutional boundaries at local, state, and federal levels. Given the proximity to Washington D.C., Montgomery County, and Prince Georges County in Maryland, NRO interacts significantly with agencies in those areas for traffic management and incident management. Several Washington D.C., 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.

Table 3.2 below shows a subset of the diverse group of stakeholders with whom NRO interacts in the region, statewide, and adjoining states. Details of these interactions and the definitions of the roles of the stakeholders are available through the NRO Regional ITS Architecture (www.vdot-itsarch.com)

NRO Partners/Stakeholders
MATOC
CAPWIN
District of Columbia Public Safety and Emergency Management
Federal Law Enforcement
Maryland Public Safety and Emergency Management
VDOT Central Office Emergency Management
Virginia State Police
NRO Local Public Safety and Emergency Management Agencies
District (of Columbia) Department of Transportation
Dulles Greenway
Federal Agencies
I-95 Corridor Coalition
Maryland Department of Transportation (MDOT)
Metropolitan Washington Council of Governments
Metropolitan Washington Airport Authority
National Park Service
Local Universities and Research Facilities
VDOT Central Office – Operations
Virginia Department of Motor Vehicles
Virginia Railway Express (VRE)
Local Transportation Agencies (Fairfax County DOT, Arlington County DOT etc)
Washington Metropolitan Area Transit Authority (WMATA)
NRO Local Transit Agencies
Private HOT Operators
Northern Virginia Transportation Commission (NVTC)
Event Promoters
Media
Private Sector Information Sharing Providers
VA Statewide Video Sharing Clearinghouse

Table 3.2 – NRO Partners/Stakeholders

Many major, high-visibility transportation system reconstructions and improvements are underway and planned for the immediate future in the Washington metropolitan region. These projects will require significant coordination among regional transportation agencies during both planning and construction. Table 3.3 summarizes some of these major projects.

Major Regional Transportation Projects	
BRAC – Related Projects/Ft. Belvoir	An estimated 21,000 people will be added to the Ft. Belvoir area as a result of Base Realignment and Closure by 2011.
Dulles Rail Project	WMATA, Fairfax County, Loudoun County, Town of Herndon, and the Metropolitan Washington Airports Authority (MWAA) are participating in the construction of a 23.1-mile transit extension to Dulles airport, traversing through the rapidly growing Dulles Corridor in Fairfax and Loudoun counties, Virginia. Most of the extension will be constructed in the median of the Dulles International Airport Access Highway and Dulles Connector Road, but the alignment also serves Tysons Corner and Dulles Airport. Construction on the first phase of the Metrorail is expected to begin in early 2007. Phase I will branch off the Orange Line west of East Falls Church Station and pass through Tysons Corner (4 stops) to Wiehle Avenue (1 stop) in Reston. It is scheduled to be completed by 2013.Phase 2 construction is likely to begin in 2010. Phase II will extend the Metrorail from Wiehle Avenue to Dulles International Airport and into eastern Loudoun County. The project is scheduled to be completed by 2015.
I-495 HOT Lanes	The I-495 Virginia HOT Lanes project, which is expected to be completed in early 2013, will include fourteen miles of HOT lanes - two new lanes in each direction - from the Springfield Interchange to just north of the Dulles Toll Road.
I-95/I-395 HOT Lanes	This project will extend the existing High Occupancy Vehicle (HOV) lanes on I-95/395 from two to three lanes and extend two new lanes south to Massaponax. All of these lanes will become High Occupancy Toll (HOT) lanes.
I-66 Widening 234 Bypass – Route 29	This project will widen two miles of Interstate 66, from the Route 234 Bypass to Route 29 in Gainesville. Two lanes will be added to I-66 in each direction, one regular and one HOV lane. The inside lane is reserved for two-person carpools during peak periods. The median will be preserved to accommodate future barrier-separated HOV lanes or transit. The project is scheduled to be completed in August 2010.
I-95 Widening at Newington	This project adds a fourth general purpose lane in each direction to I-95 from Route 123 at the Occoquan River to the Fairfax County Parkway/Route 7100. The eight-mile widening project was advertised for construction bids in September 2007 and construction began in early 2008. The widening will take four years to complete.
Wilson Bridge – Telegraph Road Interchange	As part of the Woodrow Wilson Bridge mega project, which is on its way to completion, the Telegraph Road Interchange project involves the complete reconstruction of the existing interchange to include ramp improvements, bridge widening/lengthening and widening of the I-95/I-495 mainline roadway section from 2.08 miles west of Telegraph Road to 0.5 miles to the east. This project has introduced, for the first time in Northern Virginia, a variable speed limit system designed to improve safety on I-95/I-495 in the construction area.

Table 3.3 – Major Regional Transportation Projects

IV. NRO Strategic Direction

This chapter establishes the overall strategic direction for NRO by identifying needs, a vision and mission statement, goals and objectives, and measures to evaluate progress toward goals and objectives. The needs, goals, and objectives presented here are not prioritized. Decisions about which of the needs, goals, and objectives may receive the greatest attention within a given fiscal year are made through the annual planning and programming process described in Chapter VII. This approach allows NRO to adapt dynamically to funding availability, opportunities, and other factors that change annually while maintaining an overall strategic direction established by this plan.

4.1 Needs

Transportation operations-related needs played a primary role in defining the NRO Strategic Plan. Needs were a major driver of the goals and objectives and performance measures presented in this chapter and the specific strategies presented in Chapter V.

Needs were assembled from a variety of sources, including the *NoVA Smart Travel Program Plan* (2006), the Fiscal Year 2009 NRO Programming Workshop, the *Fredericksburg Area Metropolitan Planning Organization 2035 Long Range Transportation Plan*, and discussions with transportation agency stakeholders. Needs include those that focus on outcomes, such as reducing the number and severity of crashes, as well as needs that identify what tools and capabilities NRO needs in order to achieve those outcomes. Needs have been restricted to those for which NRO can play a leading role. NRO needs are listed in Table 4.1.

NRO Needs
a. Enhance coordination of regional emergency response.
b. Improve incident and emergency information sharing.
c. Improve incident detection and verification.
d. Expand traveler information system coverage.
e. Improve transit and emergency vehicle signal operations.
f. Expand and enhance the coordination of traffic signal systems.
g. Improve pre-trip and en-route traveler information
h. Expand VDOT Transportation Operations Center (TOC) coverage.
i. Improve field coordination between VDOT and emergency responders.
j. Enhance traffic surveillance for travel time measurements.
k. Provide more parking information to travelers and agencies.
l. Coordinate data collection activities with other agencies to minimize duplication, maximize data compatibility, and make the most of each agency's investments.
m. Enhance regional VDOT communications to improve data collection and information dissemination with agencies and the public.
n. Enhance maintenance and compatibility (with other agencies) of VDOT operations technologies asset inventory.

NRO Needs
o. Disseminate more timely and accurate traveler information.
p. Improve maintenance and upgrading of VDOT operations field equipment.
q. Improve the collection and dissemination (to travelers and among partner agencies) of weather information.
r. Improve safety and mobility for pedestrians and special needs travelers.
s. Reduce adverse environmental impacts of roadway travel.
t. Reduce delays and improve safety at rail crossings.
u. Minimize the number and severity of traffic crashes.
v. Promote the efficiency and convenience of transportation payment collection.
w. Reduce delays and improve safety in work zones.
x. Extend the life of pavements and structures.
y. Promote compatibility between NRO infrastructure and emerging advanced vehicle systems.
z. Reduce the variability in travel times.
aa. Enhance corridor-level traffic management.
bb. Support regional multi-modal traveler information resources.
cc. Preserve useful operations data and make it accessible for planning and analysis.
dd. Coordinate with other agencies on the scheduling and traffic management associated with roadway construction and maintenance.
ee. Improve deployment of NRO vehicles for incidents and emergencies.

Table 4.1 – NRO Needs

4.2 Vision

A vision is a concise description of the desired end state that an organization wishes to achieve. A good vision is ambitious and motivational in so much as it identifies an ideal end state rather than one that is compromised by resource or other constraints. By means of example, at one point the vision of Microsoft was “A computer on every desk running Microsoft software.”

The NRO vision is:

Making roadway travel safe, efficient, and reliable.

4.3 Mission Statement

A mission statement describes the function or overall purpose of an organization. For example, the mission of a school might be defined as educating students.

The NRO mission statement is:

- Serve the public by providing them with the information they need to make good travel decisions, including using multiple travel modes, and by responding quickly and effectively to their questions and concerns

- Monitor real-time traffic conditions and the condition of our infrastructure throughout the system
- Proactively and rapidly identify problems, including traffic congestion, crashes and other incidents and infrastructure maintenance needs
- Take rapid and effective action to address current and developing problems, appropriately applying a range of methods including physical improvements, traffic signal strategies, incident and emergency management strategies, enhanced maintenance, and various advanced technology strategies
- Share information, coordinate responses, and plan jointly with our partner organizations.

4.4 Goals and Objectives

The NRO goals and objectives identify what is to be accomplished rather than how it is to be accomplished. The "how" is identified through the strategies presented in Chapter V.

NRO goals and objectives were developed based on a review of a wide variety of Virginia, Northern Virginia and national references, including:

- The previous (2006) NoVA Smart Travel Program Plan
- Other VDOT statewide and Northern Virginia plans and other documents
- The "Intelligent Transportation Systems Decision Support Tool" developed by NRO
- The USDOT Intelligent Transportation Systems strategic plan and system architecture.

The NRO goals and objectives—presented in Table 4.2—are organized into the following three major categories that were identified by VDOT Commissioner David Ekern in his "FY 08 Focus Area" presentation:

- Transforming the System
- The Way We Do Business
- Reshaping/Redeveloping the Workforce.

Goals and Objectives	
Transforming the System	
1. Reduce Congestion	a. Reduce travel times and delays for all modes along identified major corridors
	b. Improve travel time reliability on major corridors
	c. Actively manage travel demand on NRO facilities
	d. Reduce delays due to work-zones and planned special events
	e. Reduce incident clearance times
2. Improve Safety	a. Reduce vehicular crashes
	b. Reduce pedestrian and bicyclist crashes

Goals and Objectives	
Transforming the System	
3. Enhance Communication with Travelers	a. Provide proactive, timely, and accurate information and responses to the traveling public.
4. Promote Environmental Responsibility	a. Reduce energy consumption and environmental costs of transport operations
5. Preserve and Manage an Integrated Traffic Management System	a. Maintain field infrastructure so that it operates reliably
	b. Improve information gathering on freeways and arterials
6. Improve Emergency Management	a. Enhance coordination of regional emergency management
	b. Reduce NRO critical asset vulnerability
The Way We Do Business	
7. Improve the NRO Business Process	a. Optimize operations planning, programming and project delivery time
	b. Make the rationale for all NRO investments clear and consistent
	c. Make performance-based decisions
	d. Utilize equal employment opportunity practices in hiring and procurement decisions
	e. Minimize project cost and schedule overruns
8. Improve Regional Operations Coordination and Efficiency	a. Encourage application of technology-based operations solutions in all relevant construction projects
	b. Improve operations planning with regional operations partners
	c. Improve day to day information exchange with regional operations partners
Reshaping/Redeveloping the Workforce	
9. Enhance and Develop NRO Workforce Capabilities	a. Enhance workforce needs planning to prepare for the future operations
	b. Support and sustain a learning environment for NRO staff
	c. Attract and retain a diverse talented workforce
	d. Reduce workplace accidents

Table 4.2 – Goals and Objectives

4.5 Measuring Progress

Goal and objective setting is of little value if an organization cannot measure their progress toward achieving those goals and objectives and effectively communicate that progress to both technical and non-technical audiences. This section presents two types of performance measures:

1) Objective Tracking Measures – Provide at least one key measure for each of the 24 objectives identified in Section 4.4. These measures are intended to help NRO internally track progress towards meeting the objectives. This longer, more detailed set of measures is suitable for technical audiences.

2) Publicly Reported Measures – More limited in number, these "vital few" measures provide a higher-level picture of NRO performance suitable for the public and other non-technical audiences. These measures include a subset

of those reported on the VDOT Dashboard website plus an additional, important measure.

The objectives tracking measures are presented in Section 4.5.1. The publicly reported measures are presented in Section 4.5.2.

Data availability and consistency with measures currently collected by VDOT and/or NRO were key considerations in development of the measures presented here. The measures have been developed to take maximum advantage of data that is currently available and measures that are reported on the VDOT Dashboard and other sources.

The measures presented here provide an effective means to chart and communicate NRO progress toward carrying out this Strategic Plan. However, these measures are only a part of a much broader set of policies, processes, and tools that would enable a pervasive "objectives-driven, performance-based management culture" at NRO. Chapter V of this Strategic Plan includes a strategy within the "Enabling Activities" Program Area that will move NRO in that direction. A key part of that evolution will be to establish specific levels of performance for each performance measure and a timeline for achieving those levels.

4.5.1 Objectives Tracking Measures

Table 4.3 presents the NRO objectives tracking measures.

Objectives Tracking Measures		
Goals	**Objectives**	**Tracking Measure(s)**
Transforming the System		
1. Reduce Congestion	a. Reduce travel times and delays for all modes along identified major corridors	• Travel times on key commuter Routes (during peak commuter hours) • Vehicle-hours of recurring delay along key corridors in NRO
	b. Improve travel time reliability on major corridors	• Travel time reliability (buffer time) for identified corridors in NRO
	c. Actively manage travel demand on NRO facilities	• Person throughput (persons traveling through a roadway section per hour) measured for both general purpose and HOV lanes • Park-n-Ride utilization rate
	d. Reduce delays due to work-zones and planned special events	• Vehicle-hours of delay
	e. Reduce incident clearance times	• Average incident duration
2. Improve Safety	a. Reduce vehicular crashes	• Total number of crashes and breakdown of injury, fatal, and work zone crashes
	b. Reduce pedestrian and bicyclist crashes	• Number of pedestrian and bicyclist incidents
3. Enhance Communication with Travelers	a. Provide proactive, timely, and accurate information and responses to the traveling public	• Citizen survey results • Number of unique 511 and website users within NRO

Objectives Tracking Measures		
Goals	**Objectives**	**Tracking Measure(s)**
Transforming the System *(continued)*		
4. Promote Environmental Responsibility	b. Reduce energy consumption and environmental costs of transport operations	• Percentage of projects compliant with VDOT environmental requirements. • Wasted fuel per traveler (gallons)
5. Preserve and Manage an Integrated Traffic Management System	a. Maintain field infrastructure so that it operates reliably	• Daily percentage of "active" detectors, dynamic message signs (DMS) and closed-circuit television cameras (CCTV) (averaged over each month)
	b. Improve information gathering on freeways and arterials	• Percentage of lane-miles by functional class covered by vehicle detectors, environmental sensors, and CCTV
6. Improve Emergency Management	a. Enhance coordination of regional emergency management	• Percentage of emergency management stakeholders (identified in NRO architecture) in the region who have participated in NRO emergency management planning exercises
	b. Reduce NRO critical asset vulnerability	• Number of intrusions/security breaches of critical assets
The Way We Do Business		
7. Improve the NRO Business Process	a. Optimize operations planning, programming and project delivery time	• Average duration between when a project is programmed to when it is fully operational
	b. Make the rationale for all NRO investments clear and consistent	• Percentage of projects in any given fiscal year funding plan that were selected by the prioritization model
	c. Make performance-based decisions	• Percentage of projects in each fiscal year funding plan that are selected by the prioritization model • Percentage of objective-tracking measures for which performance targets have been defined • Percentage of project proposals that include estimated impacts on performance targets • Inclusion of estimated project performance impacts in annual prioritization process
	d. Utilize equal employment opportunity practices in hiring and procurement decisions	• Percentage of project funding allocated to Small, Women or Minority Owned (SWAM) businesses
	e. Minimize project cost and schedule overruns	• Percentage of projects on-time • Percentage of projects on-budget
8. Improve Regional Operations Coordination and Efficiency	a. Encourage application of technology-based operations solutions in all relevant construction projects	• Percentage of construction projects which have technology-based operations strategies in their transportation management plans and in final construction
	b. Improve operations planning with regional operations partners	• Percentage of regional operations stakeholders (identified in NRO architecture) expressing satisfaction with NRO participation in regional planning coordination
	c. Improve day to day	• Percentage of regional operations

Objectives Tracking Measures		
Goals	**Objectives**	**Tracking Measure(s)**
	information exchange with regional operations partners	stakeholders (identified in NRO architecture) expressing satisfaction with NRO participation in day to day information sharing
Reshaping/Redeveloping the Workforce		
9. Enhance and Develop NRO Workforce Capabilities	a. Enhance workforce needs planning to prepare for the future operations	• Completion of NRO-wide workforce planning exercise • Completion of NRO employee survey
	b. Support and sustain a learning environment for NRO staff	• Average hours per staff spent in learning activities
	c. Attract and retain a diverse talented workforce	• Average time to complete hiring process • Workforce diversity profile
	d. Reduce workplace accidents	• Number of workplace incidents to NRO staff (including field personnel)

Table 4.3 – Objectives Tracking Measures

4.5.2 Publicly Reported Measures

The NRO performance measures to be shared with the public consist of a subset of the measures reported on VDOT Dashboard public website (http://dashboard.virginiadot.org/).

Table 4.4 presents the NRO publicly reported performance measures.

NRO Publicly Reported Measures	
Category	**NRO Measure**
Safety	Total Number of Crashes on the NRO system
	Number of fatalities on the NRO system
Mobility	Percentage of Interstate Vehicle Miles Traveled at “Good” Level of Service
Customer Service	Overall Satisfaction with VDOT NRO
Project Delivery	Percentage of Projects Completed both On-Time and Within-Budget

Table 4.4 – NRO Publicly Reported Measures

NRO has excellent data on safety and project delivery-related measures. The freeway monitoring system will provide the basis for the calculation of the mobility measure although the locations of the detectors and the Level of Service criteria will need to be defined. Customer service and satisfaction levels can be measured either by piggy-backing on statewide customer surveys or by tabulating the customer complaints from the DOcuments Tracking System (DOTS).

V. Program Plan

This chapter identifies the strategies that NRO will pursue to address the needs, goals, and objectives identified in Chapter IV. These strategies are restricted to those where NRO will play a leading role, which includes many strategies in which NRO partners with other transportation organizations. This strategic plan does not prioritize strategies. Those priorities will be determined through the annual programming process discussed in Chapter VII.

The strategies were developed based on a review of various documents, conversations with NRO leadership and staff, outreach meetings with agency stakeholders, and by comparing current activities against the NRO needs, goals, and objectives.

5.1 Overview of Program Areas

NRO strategies have been organized into these 11 categories, or "Program Areas:"

1. Traveler Information
2. Corridor/Congestion Management
3. Emergency Management
4. Incident Management
5. Road-Weather Management
6. Safety and Incident Prevention
7. Regional and Statewide Coordination
8. Construction and Work Zone Management
9. Data Management
10. Asset Management
11. Enabling Activities.

Note that the full spectrum of activity covered in the *VDOT Statewide Emergency Response Plan* is addressed in this strategic plan, but those activities have been subdivided into the Incident Management, Road-Weather Management, and Emergency Management Program Areas.

5.2 Linkage to Goals and Objectives

The strategies contained in the 11 Program Areas are directly linked to the goals and objectives presented in Chapter IV. The strategies represent the methods and activities—the "tools in the tool box"—that NRO will use over the next several years to work toward the goals and objectives.

To ensure that each strategy can be clearly linked to one or more goals and objectives, each of the approximately 70 strategies contained in the 11 Program Areas presented in Section 5.3 have been mapped against the 24 NRO objectives. A detailed matrix showing the results of that mapping exercise is presented in Appendix A. That mapping demonstrates that each objective is addressed by at least one strategy and that every

strategy responds to at least one objective. Table 5.1 presents a simplified summary of that mapping by aggregating the strategies up to the Program Area level. The numbers in the table below indicate the number of strategies within a program area that address an objective. Table 5.1 confirms that each objective is supported by at least one strategy/program area and that many objectives are addressed through a combination of strategies from multiple program areas.

Number of Strategies by Program Area that Address Various NRO Objectives

	Program Areas (with total number of strategies in each shown in parentheses)										
Objectives	Traveler Info. (8)	Corridor/ Congestion Mgt. (11)	Emergency Mgt. (6)	Incident Mgt. (12)	Road Weather Mgt. (5)	Safety & Incident Prevention (6)	Regional & Statewide Coord. (3)	Construction & Work Zone Mgt. (3)	Data Mgt. (4)	Asset Mgt. (3)	Enabling Activities (13)
Goal 1: Reduce Congestion											
a - Reduce travel times and delays for all modes along identified major corridors	1	10		4	1	1		1	1		
b - Improve travel time reliability on major corridors	2	8		2	2	1		1			
c - Manage travel demand on NRO facilities	5	5		1		1		1			
d - Reduce delays due to work-zones and planned special events	2	2		2			1	3		1	
e - Reduce incident clearance times	1	4	1	10			1				
Goal 2: Improve Safety											
a - Reduce vehicular crashes		1			3	5					
b - Reduce pedestrian and bicyclist crashes		0				1					1
Goal 3: Enhance Communication w/ Travelers											
a -Provide proactive, timely, and accurate information and responses to the traveling public.	8	1	1	3	1	3					
Goal 4: Promote Environmental Responsibility											
a - Reduce energy consumption and environmental costs of transport operations	2	4						1			
Goal 5: Preserve and Manage an Integrated Traffic Mgt. Sys.											
a - Maintain field infrastructure so that it operates reliably	1	3		4	2		1			3	
b - Improve information gathering on freeways and arterials	3	4		2		1	1	2	1		
Goal 6: Improve Emergency Mgt.											
a - Improve coordination of regional emergency management	1	2	4	10	4		2				
b - Reduce vulnerability of critical NRO assets to security risks			2								
Goal 7: Improve the NRO Business Process											
a - Minimize operations planning, programming, and project delivery time							1				1
b - Make the rationale for all NRO investments clear and consistent											1
c - Make performance-based decisions									3		2
d - Utilize equal employment opportunity practices in hiring and procurement decisions											1
e - Minimize project cost and schedule overruns											2
Goal 8: Improve Regional Operations Coord. & Efficiency											
a - Include ITS/Operations in all relevant construction projects	1						1	2			
b - Improve operations planning with regional operations partners	1		1	2			3	2			
c - Improve day to day information sharing with regional operations partners	2	4	2	3			2	1			
Goal 9: Enhance & Develop NRO Workforce Capabilities											
a - Enhance workforce needs planning to prepare for the future operations											5
b - Support and sustain a learning environment for NRO staff											5
c - Attract and retain a diverse talented workforce											5
d - Reduce workplace accidents											1

Table 5.1 – Number of Strategies by Program Area that Address Various NRO Objectives

Notes:

1. The total number of strategies in each program area is identified at the top of the program area column. In the rows below, the number of strategies within each program area that support each NRO objective are identified. For example, one of the eight strategies in the

Traveler Information Program Area support Goal 1a; all eight of the strategies support Goal 3a; three of the strategies support Goal 5b; etc.

2. Within a given program area, the column totals always exceed the total number of strategies within that program area because many strategies address multiple objectives.

5.3 Program Areas

This section presents the 11 Program Areas. Each Program Area includes a brief overview followed by the strategies. Linkages to the NRO Regional Architecture are identified in Appendix B.

5.3.1 Traveler Information

Traveler Information refers to the dissemination of any trip or route-related information provided to a traveler or potential traveler. This information may include: real-time traffic conditions, construction information, weather information, emergency advisories and alerts, the availability and conditions of public transportation, parking availability, and information concerning carpooling, ride-sharing and transit connections.

5.3.1.1 Overview

NRO is currently involved in many traveler information activities, including those focusing on NRO-owned and operated systems as well as those that entail coordination with VDOT statewide systems and/or regional systems operated by other agencies in Northern Virginia. NRO provides travelers information through the statewide 511 telephone system and a new, updated website; operates just over 200 DMS; operates a highway advisory radio (HAR) system; and shares traveler information with the media and private-sector vendors who in turn disseminate the information to travelers, including various "value-added" features like weather information and customized information. NRO also operates a customer service center that travelers can call for information. NRO also shares traffic video data through a central video clearinghouse to other public and private agencies as well as to the public.

5.3.1.2 Strategies

The following strategies carry out traveler information related activities:

TI-1. Device Master Planning and Project Development – Several Device Master Planning efforts have been initiated within NRO in the last few years for upgrading the DMS, CCTV, and vehicle detectors network. As several of the traveler information strategies being discussed in NRO have significant real-time data requirements, upgrading the vehicle detection infrastructure is a priority strategy. NRO is also in a process of completely revamping their DMS and CCTV networks. NRO will begin deployment in 2008 by bundling DMS with CCTV and vehicle detection systems in prioritized corridors throughout the region. In addition to detectors, DMS, and CCTV, NRO has initiated a program for telecommunications master planning and improvement. The telecommunications upgrade will greatly enhance applications involving

communication with field devices. NRO is also considering master plans for ramp metering devices, HAR, and road weather information systems (RWIS).

TI-2. Travel Times on DMS and 511 – NRO is currently working on a project to post travel times on DMS signs on I-66, and the I-95/I-395 corridors. Various data sources are being considered and the system requirements are being developed. The travel time data will also be posted to the 511 website and phone system.

TI-3. D.C. Region Traveler Information Efforts – NRO continues to participate and support the D.C. region's efforts toward 511 including sharing operations and incident data through the Regional Integrated Transportation Information System (RITIS), a regional data clearinghouse (see the Regional and Statewide Coordination Program Area for more details).

TI-4. Portable Technologies for Construction Zones – As several construction projects begin to take shape in the region, as a short-term measure, NRO envisions the use of portable CCTV, DMS, and/or HAR to provide construction and work zone information to travelers.

TI-5. Traveler Information Kiosks and Displays – To support demand management, NRO is considering the installation of traveler information plasma displays or kiosks at major commercial centers and employment hubs in the region. Traveler information on the kiosks includes traffic conditions, transit options, travel demand management (TDM) strategies, construction information, and weather-related information.

TI-6. Real-Time Multi-modal Traveler Information – Real-time transit information is a high-priority need in the region with several transit providers operating bus and rail services in the region. True multi-modal information with real-time transit information and trip planning tools are being envisioned as a strategic priority for the DC metropolitan region. While not anticipating a lead role, NRO will continue to support progress towards multi-modal information by sharing, as needed, traffic and incident information with transit traveler information systems.

TI-7. Regionally Disseminated Real-Time Park-and-Ride Information – VDOT operates several park-and-ride lots in the region and NRO would like to provide parking availability information through DMS at key decision points and via regional traveler information sources like the 511 telephone traveler information system.

TI-8. Alternative Data Collection and Fusion Approaches – NRO is strongly considering an increased role for the private sector to supplement road condition data and to provide enhanced traveler information. Such data could come from commercial fleets, probes, toll tags and other non-intrusive technologies and could be fused with existing VDOT data for enhanced coverage of the VDOT road network. Correspondingly, VDOT will also increasingly make their data sources available to the private sector for use in commercial traveler information applications.

5.3.2 Corridor/Congestion Management

Corridor/Congestion Management consists of the operational coordination of multiple transportation networks and cross-network connections comprising a corridor, and the coordination of stakeholders responsible for corridor mobility and congestion reduction. It includes managing the capacity from multiple transportation networks including freeways, arterials, and public transportation to improve the efficiency of the overall transportation system instead of individual sections of the roadway. This area focuses on maximizing throughput and reducing delays during normal travel conditions.

5.3.2.1 Overview

This is a primary NRO activity with cross-cutting applications and functions. Within NRO, the focus is to enable a coordinated approach to freeway, arterial management, and transit coordination. Freeway management is currently focused on improving the safety, efficiency, and reliability of travel on NRO freeway facilities. It includes a wide range of control strategies including ramp metering, mainline lane controls, HOV lanes, and gate-controlled reversible high occupancy vehicle (HOV) lanes. The Freeway Management System became operational in 1985 and is located in the Traffic Operations Center (TOC).

From the TOC, NRO monitors and manages traffic, recognizes and responds to incidents, and delivers traveler information to motorists. The TOC operates and controls field devices that are typically located along the roadside and which support traffic monitoring and traffic management. The TOC also coordinates with other agencies for responding to incidents and emergencies and participates in a regional incident management plan. The TOC manages the VDOT-owned traffic signals within the NRO boundaries.

The Northern Region relies heavily on the services provided by a number of transit agencies. WMATA provides transit bus and rail service and the Virginia Railway Express (VRE) provides commuter rail service in the Washington DC metropolitan area. NRO coordinates traffic, incident, and transit information through direct communications with the transit agencies. Traffic signal priority for transit buses is being considered by local jurisdictions as well as NRO to improve schedule adherence of transit agencies and the overall roadway network usage efficiency.

5.3.2.2 Strategies

The following strategies carry out corridor/congestion management related activities:

C/CM-1. Device Master Planning and Project Development – NRO is in the process of completely revamping their DMS, vehicle detection, and CCTV networks. CCTV camera surveillance and vehicle detection is vital to corridor management and is currently used for incident verification and monitoring of traffic conditions from the TOC. All these device and communication upgrades are going to be deployed in corridor-specific bundles throughout the Northern Region.

C/CM-2. Advanced Traffic Management System (ATMS) Replacement – As part of an ongoing, multi-phase project, the TOC control software is being

replaced with a new version with enhanced capabilities and full integration with most of the field devices. The successful implementation of the ATMS software will have to precede several of the advanced traffic management strategies.

C/CM-3. Traffic Signal Retiming – NRO is in the process of increasing the frequency with which it retimes its traffic signals from every four years to every two years. This will improve traffic flow and reduce delays for recurring conditions as well as keep special event timing plans more up-to-date. The benefits will be greatest in high-growth areas where traffic volumes are increasing rapidly. NRO also has evacuation timing plans in place to be enacted during emergencies or major regional traffic events (e.g., Fourth of July fireworks).

C/CM-4. Traffic Signals Master Planning – NRO is currently participating in a research/planning effort to identify and implement best practices and technologies in next-generation traffic signal hardware and communications. This planning effort will also be supported by identification and installation of new traffic signals as needed throughout the Northern Region.

C/CM-5. Coordination of Traffic Operations with HOT Lanes – NRO's corridor/congestion management efforts are supplemented by other ongoing efforts in the region, the primary one being the High Occupancy/Toll (HOT) Lanes to be constructed on I-495 and I-395/I-95. NRO is a key stakeholder and has been involved from the planning stages with the HOT developers. As these facilities become a reality, NRO will continue to adapt corridor management strategies to maximize the efficiency of the NRO transportation network.

C/CM-6. Integrated Corridor Management (ICM) – NRO has been following federal efforts on ICM demonstrations and continues to assess applicability to the NRO corridors. NRO hopes to take a more inclusive view of managing corridors including coordinating with transit partners for operations and managing incidents using a parallel route as a relief valve (e.g. Rte 1 and I-95).

C/CM-7. Bottleneck Mitigation Program –Currently NRO has an intersection improvement program that aims to provide low-cost improvements to intersections to mitigate bottlenecks. NRO plans to continue the program but also expand it to provide low-cost improvements at targeted locations on interstates (e.g., ramps, merge areas, locations with sudden changes in highway alignment, etc.) or small corridors of delay.

C/CM-8. Access Management – Access management seeks to improve the performance of the existing road network and enhance safety while maintaining the right of private property to have reasonable access to state highways. To accomplish this, highways are classified according to their function, moving traffic versus providing access to property. Regulations and standards based on a highway's functional or operational

classification are used to manage the location, number, spacing, and design of entrances, median openings, traffic signals, turn lanes, street intersections, and interchanges. VDOT and NRO have been applying access management principles for many years. Additional focus and direction has recently been provided through Virginia General Assembly legislation passed in 2007 and 2008. As a result of that legislation, VDOT is implementing statewide access management regulations and design standards in phases, by roadway functional class. The first phase applies to highways classified as principal arterials. The second phase applies to VDOT highways classified as minor arterial, collector, and local. This strategy encompasses continuation of NRO access management activities and incorporation of and compliance with the emerging statewide regulations and design standards.

C/CM-9. Active Traffic Management on Key Corridors – NRO has recently initiated a study of the potential for active traffic management strategies to improve recurring congestion along key NRO corridors. An example of such a synergistic system is being deployed in the near-term as part of the Woodrow Wilson Bridge construction project, but NRO is also interested in the ability of a similar system to improve traffic flow and safety on I-66.

a. Speed Harmonization – NRO is investigating variable speed limits as an approach to harmonize speeds to improve safety as well as maintain/increase throughput.

b. Queue Warning Systems – NRO is identifying potential locations where queue notification and warning systems can help in reducing vehicle speed deferential and alleviate bottlenecks. Currently, a video-based system is planned.

c. Dynamic Lane Control Systems – NRO plans to expand and improve current lane control systems to be more traffic responsive and dynamic rather than operate in a time-of-day mode. By dynamically varying the lane control systems, NRO hopes to mitigate congestion, especially incident and non-recurring delays.

d. Traffic Responsive Ramp Metering – The ramp metering system in use by NRO runs in time-of-day mode and is therefore not as effective as it could be. The current ramp metering firmware is capable of traffic responsive operation, though there are other systems in use across the country with more sophisticated algorithms that may warrant study.

e. Arterial Management – Arterial Management focuses on managing the efficiency and safety of arterials in coordination with adjacent limited-access facilities. Techniques include dynamically adjusting traffic signal timing plans on arterial streets in real time in response to traffic diversions from parallel freeways.

C/CM-10. Travel Demand Management (TDM) – With funding constraints and limited roadway capacity, demand management continues to be a critical strategy in the Northern Region. While continuing to support traditional TDM measures such as carpools, vanpools and employer incentives which are managed by various agencies in the region, NRO hopes to broaden TDM to encompass traveler information, alternate routing, and other measures. NRO also hopes to promote these strategies via DMS, websites, kiosks, etc.

C/CM-11. Parking Management – NRO would like to enhance monitoring and management of parking facilities, especially Park-and-Ride lots owned by VDOT, and promote multi-modal traffic management measures to minimize unnecessary traffic circulation on roads and in the managed lots. Enhancements would include management of parking operations and current parking status information dissemination. Regionally, there is expected to be coordination between the VDOT-owned parking facilities and WMATA and VRE parking management to enable regional parking management strategies, especially during special events.

5.3.3 Emergency Management

Emergency Management encompasses public safety, emergency management, and other allied agency systems that support disaster response and evacuation, security monitoring, and other security and public safety-oriented operations technology activities. The 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. Emergency management includes the functions associated with Emergency Operations Centers (EOCs) that are activated at local, regional, state, and federal levels for emergencies and the portable and transportable systems that support Incident Command System (ICS) operations at an incident.

5.3.3.1 Overview

VDOT recently released its long-term action plan to improve emergency response and to refocus on its critical emergency response mission statewide. The plan outlines 13 action steps detailing the VDOT commitment to focus on its vital role as an emergency response agency. The emergency plan outlines action items for four classes of incidents: weather related, major and minor crashes, hazardous materials, and terrorist attacks. The central themes of the statewide plan are to:

- Improve communications with the public and media to guarantee they are informed about the impact incidents are having on transportation safety
- Implementing best practices statewide for consistent, dependable, and timely response to incidents
- Adopting the National Incident Management System principles and procedures applicable to all incidents and recognizing VDOT's role as a first responder agency

- Improving and institutionalizing incident response training
- Improving coordination with and support for other state, federal and local agencies involved in incident response.

Under the leadership of the VDOT Central Office, NRO will support the planning and implementation of the statewide emergency response plan by implementing a number of actions. In this strategic plan, those actions have been subdivided into this program area (Emergency Management) and the related Incident Management and Road Weather Management Program Areas.

Coordinated emergency response in Northern Virginia involves multiple stakeholders in the region and NRO will continue to participate in CapWIN and the planned MATOC center.

5.3.3.2 Strategies

The following strategies carry out emergency management related activities:

EM-1. Regional Evacuation Route Management – NRO will continue to fine tune their evacuation strategy and move beyond identification of routes to development of standard operating procedures and protocols, contraflow guidelines, roles and responsibilities and systems monitoring. Any technologies and field deployments necessary for effective deployment (portable and static signage, barrier gates, lane control systems, etc.) will be identified and deployed.

EM-2. TOC as Incident Command Post – Expand the focus of the TOC beyond traffic management to include responsibility for active emergency response. The TOC will serve as the command post for all significant events.

EM-3. Public Information Protocols and Procedures for Emergency Management – including clear protocols to trigger involvement of VDOT Public Affairs in providing public information during emergency response.

EM-4. Enhanced Use of Evacuation Planning Analysis Tools – Apply available analysis methods and tools (e.g., IDAS and DYNASMART-P) to support evacuation planning.

5.3.4 Incident Management

Incident Management is the capability to manage unexpected incidents and planned events so that the impacts to the transportation network and traveler safety are minimized. This includes incident detection capabilities through roadside surveillance devices and regional coordination with other traffic management agencies. Depending on the nature of the incident, the response may include traffic control strategy modifications or resource coordination between the various transportation centers in the region. Incident response also includes presentation of information to affected travelers and sharing information with other agencies that might be impacted by the event. Activities pertaining to large-scale disruptions in the region are covered under the Emergency Management Program Area.

5.3.4.1 Overview

The incident management system is highly integrated with the freeway management system in NRO through the TOC. The TOC provides all dispatching and two-way radio capability, highway advisory radio, collection of real-time data to detect incidents, and CCTV to verify incidents.

The TOC monitors the Virginia State Police (VSP) Computer-Aided Dispatch (CAD) system for incident detection. The TOC is continuing the transition to automatic system integration with VSP CAD and Fairfax County CAD systems as the main means of automatic incident detection as part of the McConnell Public Safety and Transportation Operations Center (MPSTOC). MPSTOC also co-locates public safety personnel (VSP, Fairfax County) with NRO TOC staff to increase efficiency in incident response.

In addition to the TOC, the Safety Service Patrol (SSP) assists and performs incident clearance, on-scene traffic management, and incident management data entry (shared real-time between TOC and SSP). SSP is responsible for identifying and responding to incidents that occur on the NRO roadway system. The SSP also identifies incident locations, monitors the impact of incidents, verifies incidents, and shares incident information with the TOC and other agencies, along with removing or assisting in removing obstructions from the incident scene.

The incident information sharing responsibility mainly resides with the TOC; however, SSP does share information 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, TOC operators notify the signal operation staff to implement appropriate signal timing plans to facilitate altered traffic volumes and patterns.

Incident management is also a major function of the VSP, which is responsible for providing public safety in the State of Virginia by responding to incidents that occur on the VDOT roadway system.

Incident notification is exchanged with regional agencies like CapWIN, RITIS, DC Public Safety and Emergency Management agencies, DC DOT, Maryland CHART (Coordinated Highway Action Response Team), toll operators, event promoters, and local jurisdictions. From the TOC, incident information is also provided to private entities, media, state-wide 511 services (through VDOT VATraffic – a statewide information portal) and other traveler information outlets.

5.3.4.2 Strategies

The following strategies carry out incident management related activities:

IM-1. Device Master Planning and Project Development – In addition to traveler information and corridor/congestion management, the upgrades of NRO devices is a critical component of incident management. Detection, CCTV, in addition to traveler information, is currently used for incident verification and monitoring of traffic conditions from the TOC. DMS signs are used to convey incident information to travelers. The upgraded sensors are expected to provide quicker incident verification and response. All these device and communication

IM-2. Formalize Command and Control – Work with First Responders to implement formal structure and protocols for all incident response based on the National Incident Management System (NIMS). NRO will implement a unified command structure that integrates operations and maintenance.

IM-3. Continue CAD Integration – The TOC is currently integrated with the VSP CAD system. CAD integration with other local jurisdictions, starting with Fairfax County CAD, will be considered as necessary taking into account the potential for information overload at the TOC.

IM-4. Expand and Modernize Safety Service Patrol (SSP) Program – NRO plans to increase the coverage of the SSP program, especially focusing on the planned construction zones and priority corridors. Automatic Vehicle Location (AVL) systems are also being planned for the SSP program.

IM-5. Transition to Public Safety and Transportation Operations Center (PSTOC) – The TOC is moving to a new location which will also house VSP and Fairfax County Police as part of PSTOC. TOC and the public safety personnel will work on protocols and operating procedures to take advantage of the co-location to move towards integrated operations.

IM-6. Regional Incident Data Sharing – Sharing data on incidents is a challenge in the Northern Virginia region given the large number of stakeholders interested in such information. NRO hopes that RITIS will be the common data clearinghouse for the entire region. Regionally, MATOC will also play a role in consolidating and compiling information from different jurisdictions into a regional picture. For details on RITIS and MATOC, see the Regional and Statewide Coordination Program Area.

IM-7. Establish Northern Virginia Incident Management Group – A regional incident management group has been set-up to determine the equipment, training, and protocols necessary to achieve requirements for both internal and external agency communications under incident response scenarios. NRO will continue to participate and support the incident management group and will use the expertise of the group to improve incident management strategies, especially focusing on policy development and institutional challenges.

IM-8. Expand Law Enforcement Traffic Signal Pre-emption – Currently, limited traffic signal pre-emption exists on certain arterials in NRO. NRO will work with law enforcement agencies to determine the need and best practices for traffic signal pre-emption in the area.

IM-9. Automatic Incident Detection – As a part of a broader look at more automatic detection of incidents, NRO is considering Video Incident Detection Systems (VIDS) as part of their Active Traffic Management Strategy.

IM-10. Establish a Coordinated Efficient Clearance Program – NRO will develop a coordinated efficient clearance program along its highways with input and

agreement from various law enforcement agencies in the region. An example of such an effort is the Move-It program that is being considered for the Northern Region.

IM-11. Automated Coordination of Traffic Signals During Incidents – Currently, the TOC adjusts signal timings manually based on major incidents on adjacent freeways or on the arterial streets. NRO, with their ATMS upgrades, hopes to automate such signal timing changes (with operator oversight).

IM-12. Integrate Incident Management Plan with ATMS – Currently, the incident management plan is not directly integrated into the ATMS software. To achieve the right level of response, strategies and operating procedures suggested by the NRO incident management plan need to be available and integrated at a system-level at the TOC.

5.3.5 Road Weather Management

Road Weather Management is focused on managing weather related incidents, such as fog, flooding, wind, snow, and ice. This area includes measures to help improve safety during weather-related incidents and winter road maintenance, including snow plow operations, roadway treatments, and other snow and ice control activities. The area also includes systems to monitor environmental conditions and weather forecasts to support operations and disseminate weather related information to the traveling public.

5.3.5.1 Overview

Currently, the VDOT Transportation Emergency Operations Center (TEOC) collects and disseminates road and weather information using data collected from environmental sensors stations associated with RWIS. In addition to the current fixed sensor stations at the roadside, sensing of the roadway environment from sensor systems located on NRO maintenance and construction vehicles is planned.

The collected environmental data is used by NRO to make decisions on operations. 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 dynamic message signs.

NRO is not responsible for snow removal or other maintenance activities. The district maintenance group will be responsible for clearing the roadway system during winter events. However, NRO can play a vital role by providing proactive information and decision-making support to the maintenance group based on awareness of traffic conditions. Similarly, by integrating road weather information into TOC operations, a more proactive advisory and control strategy can be adopted.

Strategies under road weather management also support emergency management and response functions (Program Area 3) and are driven by the statewide emergency response plan.

5.3.5.2 Strategies

The following strategies carry out road weather management related activities:

RWM-1. **Automated Anti-Icing Systems** –NRO will consider the implementation of automatic anti-icing systems on bridges and other hot-spots.

RWM-2. **Expand RWIS network** – Statewide, there are ongoing efforts to expand the coverage of the RWIS network including new sites and upgrading existing sensors. NRO will collaboratively work with the VDOT Central Office to integrate the new RWIS stations into the TOC and the ATMS system.

RWM-3. **Snow and Ice Mobilization Plans** – NRO will establish a snow and ice mobilization plan that emphasize a systems approach to response including sharing of resources across existing area headquarters, residency and district boundaries. The plan is also expected to employ an "all-hazards" approach to chain of command, preparation, and communications during a weather event.

RWM-4. **Weather Responsive Traffic Management (WRTM)** – Managing traffic during adverse weather is a complex issue involving many of the other Program Areas in this plan. It is closely related to incident and emergency management and includes obtaining road weather information, interpreting trends and forecasts, pre-event decision making and resource deployment, during-event control and treatment response, and post-event recovery. NRO plans to take a systematic approach to integrate weather information into the TOC to help in decision making for advisory, control, and treatment functions. The TOC will play a lead role in determining and implementing:

- Advisory Strategies – provide information to users and managers of the transportation system on threats or changing conditions warranting a notification. Example: posting message on DMS signs (e.g. "Icy Conditions Possible Use Caution"), 511 (specific information for the road weather conditions), HAR, website, radio, and television to deliver road weather updates.
- Control Strategies – Utilize traffic control strategies (lane utilization, signals, etc.) to permit or restrict traffic flow and regulate roadway capacity during weather events. Example: weather-related signal timing, speed management, and access control operations.

5.3.6 Safety and Incident Prevention

Safety and Incident Prevention includes a wide range of solutions that all contribute to the common goal of improving vehicle and pedestrian safety. These systems have a direct impact on diminishing both the number and severity of crashes, which reduces injuries, fatalities, and societal costs. Examples of these systems include: queue warning systems, speed warning systems, truck rollover warning systems, red-light running cameras, intersection crossing warning systems, and over-height detection systems.

5.3.6.1 Overview

NRO plans to improve safety by providing motorists with warnings about adverse driving conditions, upstream disruptions in traffic, and the presence of incidents through DMS and recorded messages. The ability to quickly respond to an incident can reduce the likelihood of a secondary incident. NRO also is particularly focused on safety and incident prevention at work zones, especially given the planned construction in the region. To combat the high fatality rates on some VDOT highways, the highway safety corridor program was established in 2003. The multi-agency program provides highly visible signage, targeted enforcement and increased fines for safety violations on specific sections of the highway. In NRO, an 11–mile stretch of I-95 between Route 619 and Route 123 has been designated as a ”highway safety corridor.”

NRO is also looking at technological solutions to improve road safety including truck roll over warning systems, pedestrian countdown signals, bridge anti-icing systems, red-light running cameras, etc. Several of these will be implemented at targeted locations in order to address identified, site-specific safety concerns.

5.3.6.2 Strategies

The following strategies carry out safety and incident prevention related activities:

SIP-1. **Over-height Detection System** – An over-height detection system is currently planned for I-95 crossing over Route 17 in the Fredericksburg vicinity. This strategy will be applied as needed throughout the region.

SIP-2. **Pedestrian Countdown Signals** – As part of traffic signal replacement and upgrades, NRO will consider the installation of pedestrian countdown signals as appropriate.

SIP-3. **Speed Harmonization** – NRO is planning to implement variable speed limits to harmonize speeds and minimize speed deferential on NRO interstates.

SIP-4. **Weather Related Warning Systems** – NRO will consider deploying warning and alert systems for fog, high-wind advisories, and bridge icing. Control technologies like automated anti-icing devices will also be considered.

SIP-5. **Queue and Disabled Vehicle Warning Systems** – NRO will implement queue warning and disabled vehicle alarm systems on HOV, shoulder lanes, and reversible lanes using video analytics or other detection methods. The alarms will be reported to the TOC who will relay them to SSP.

SIP-6. **Traffic Engineering Strategies** – NRO will continue to actively undertake traffic engineering improvement programs targeting replacement, rehabilitation, and installation of guard rails, rumble strips, etc. Pavement marking programs are also ongoing within NRO.

5.3.7 Regional and Statewide Coordination

Regional and Statewide Coordination includes the communication and partnering among various operating entities, such as emergency response services, traffic management systems, and public transportation systems. Coordination can include

sharing of real-time operational data and information with various stakeholders in the region, development of coordinated response plans, transit coordination, and public-private partnerships in the region.

5.3.7.1 Overview

NRO is working with a wide range of stakeholders in making travel throughout the region as reliable and efficient as possible. One of the key initiatives in this regard is the MATOC Program, an initiative to improve inter-agency traffic operations and coordination in the greater Washington, D.C. region. It is a partnership between the District (of Columbia) Department of Transportation, Maryland Department of Transportation, VDOT, and WMATA. Its goals include:

- Strengthen multi-agency coordination among transportation response agencies during incidents based upon improved standard operating procedures and notification practices.
- Improve the technological systems by which transportation agencies can share data with each other to aid incident management.
- Improve the quality and timeliness of the information available through current sources (e.g., radio and television stations) on transportation systems conditions, especially during incidents.
- Coordinate with the University of Maryland on the separate but related RITIS data clearinghouse. RITIS will provide real-time transportation data compiled from each of the region's transportation agencies, and will be the primary source of information used within the MATOC Program.
- Help ensure transportation systems condition information is provided to emergency management and public safety agencies to aid in their responses to declared emergencies or major disasters. During such incidents, MATOC will provide transportation emergency management support to public safety agencies leading of the response.

There are two major toll facilities within the NRO boundaries—the Dulles Toll Road and the Dulles Greenway. Within the past year, the Metropolitan Washington Airports Authority (MWAA) assumed control of the Dulles Toll Road in order to direct a portion of toll revenues toward a regional Metrorail extension to Dulles Airport. The Dulles Greenway extends the Dulles Toll Road to Leesburg. It is under the ownership and control of a private firm, which performs maintenance and makes improvements on the toll way. VDOT no longer actively maintains or operates these tolled sections but coordinates with the operating entities extensively on incident and road condition information.

In addition to the existing toll facilities, the upcoming HOT lanes will have dedicated traffic management centers and traveler information services that will be primarily concerned with setting and publishing toll rates that will vary in real time to ensure that speeds on the HOT lanes do not dip below 45 miles per hour. These centers will be staffed and operated by private entities and will coordinate with the TOC. While the details regarding the breakdown of responsibilities between NRO and the private

entities have not yet been established, it is likely that the TOC will back up the HOT traffic management centers during their off hours.

Arlington County and the City of Alexandria are the two largest locally operated traffic signal systems in NRO. The cities of Falls Church, Fairfax, and Herndon also operate their own signal systems. NRO coordinates with these local agencies to maintain traffic flow across the jurisdictional borders. In addition, NRO must coordinate with these agencies in incident and evacuation scenarios.

NRO coordinates with adjacent VDOT jurisdictions and VDOT Central Office in various information sharing activities including sharing information on incidents and construction events through the VA Traffic portal. NRO is also actively involved in planning for operations with the VDOT Central Office.

5.3.7.2 Strategies

The following strategies carry out regional and statewide coordination related activities:

RSC-1. Planning Coordination – As an ongoing strategy, NRO will continue to support planning for operations both within the DC region as well as at the statewide level. These include participating in short-term and long-term strategic planning, emergency and incident response planning, and systems architecture development.

RSC-2. Continued Participation in MATOC and RITIS Development – NRO will continue to support and participate in MATOC development and deployment and in RITIS.

RSC-3. VA Traffic Integration – NRO will support the development of a statewide information portal (VA Traffic) for robust information on incidents and construction information.

5.3.8 Construction and Work Zone Management

Construction and Work Zone Management focuses on improving the mobility and safety in work zones and construction sites. While maintaining the full carrying capacity and accommodation for all users is usually not possible during construction, in most instances, the public must have some form of access through or around the work site. Even when reductions, closures, and rerouting are not necessary, construction activity often reduces quality of service for roadway users because it can be distracting and cause temporary disruptions. Developing traffic management plans, improving alternate routes of travel, providing temporary facilities, staging work to occur in off-peak hours, and providing police officer control are ways to reduce the impact of construction on roadway operations.

5.3.8.1 Overview

Given the major transportation construction taking shape in Northern Virginia, this area has become a major focus for NRO. Approximately $6.0 Billion in construction activity is planned to commence in 2008 and continue through 2012 and beyond. Major projects will occur concurrently, placing a great burden through out the region. These

include construction of 14 miles of HOT lanes on I-495, 56 miles of HOT lanes on I-395/95, I-95 widening between Newington and Dumfries, I-495 widening, and I-495/Telegraph Road interchange improvements, and Dulles Rail in Tysons Corner.

NRO directs activity in work zones, controls traffic through portable DMS and informs other centers of their activity (e.g., SSP, VSP, local public safety centers, traffic signal centers, and transit centers). Work zone information is also shared with the VA Traffic system for internal and public dissemination (through the 511 service)
NRO has maintenance facilities throughout the region.

A new section within NRO, the Operations Maintenance group, manages the repair and maintenance of equipment such as traffic controllers, detectors, dynamic message signs, signals, pavement marking, traffic static signs, and other equipment associated with the operational roadway infrastructure.

5.3.8.2 Strategies

The following strategies carry out construction and work zone management related activities:

CWM-1. **Transportation Management Plan (TMP) Development and Implementation** – NRO has devoted significant resources in developing transportation management plans for the various mega-construction projects that are expected to begin in the near future. These plans are intended to be comprehensive and include a wide variety of congestion mitigation and traffic safety approaches including transit, telecommuting, detours, traveler information, additional police and SSP deployments, and small localized network improvements. NRO will continue to play a lead role in reviewing these plans and adjust to changes in construction schedules as needed. NRO will also work with Virginia Mega Projects Construction Operations Center in sharing and coordinating information about the various high-capacity improvements in the area.

CWM-2. **Advanced Technology Applications in Highway Construction Zones** – NRO has developed a decision-support tool to help identify technology-based solutions for congestion mitigation and traffic safety in construction and work zones. It is hoped that use of this tool will encourage the deployment of more technology-oriented solutions during construction. NRO will also monitor the Woodrow Wilson Bridge (WWB) Variable Speed Limit (VSL) project and assess its suitability to other locations in the region.

CWM-3. **Lane Closure Advisory Management System (LCAMS)** – NRO has deployed a Road Closure Management System software to coordinate road work between multiple contractors and VDOT maintenance crews. NRO will focus on the increased use and institutionalizing of this tool and integration with state-level data sharing portals such as VA-Traffic.

5.3.9 Data Management

Data Management includes activities for collecting, archiving, managing, and distributing data generated from technology and non-technology sources for use in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. Activities also include preparation of data products that can serve as inputs to federal, state, and local data reporting systems.

5.3.9.1 Overview

Through the Virginia Archived Data Management System (ADMS) system and RITIS, NRO has access to archived traffic operations data for planning and mobility performance measurement, improved operational effectiveness, and decision support. ADMS Virginia is hosted at the Smart Travel Lab at the University of Virginia and is the statewide repository for traffic data. RITIS is a Washington, D.C., regional system hosted at the University of Maryland that archives data from Maryland, Virginia, and the District of Columbia for research purposes. RITIS archives incident timeline data from the NRO TOC. Using these systems, VDOT, universities, and other stakeholders can query for archived data in many different formats and use that data for analysis and performance measurement.

5.3.9.2 Strategies

The following strategies carry out data management related activities:

DM-1. **Freeway Performance Monitoring System** – NRO recently began developing a real-time freeway performance monitoring system. The system enables the TOC engineers and operators to identify, measure, and report the status of the freeway system and individual facilities at various temporal and spatial scales. Additionally, this system adds value to real time data by performing data aggregation and comparisons to historic or expected values. While development of the tool has ceased, the functionality desired by the TOC remains a need. NRO will identify and support approaches to enable TOC staff to analyze and plan using real-time traffic data.

DM-2. **NRO Dashboard** – VDOT is placing greater emphasis on system performance measurement. VDOT operates as statewide public website called “Dashboard” (http://dashboard.virginiadot.org/) to report performance in various areas, including congestion at various interstate locations, HOV travel speeds, travel times on key commuter routes, citizen survey results, and project delivery statistics. An NRO-specific dashboard will be a useful tool to monitor and report performance.

DM-3. **Quarterly Report on NRO System Performance** – Based on the dashboard, NRO is developing a performance reporting framework for the region which will be published quarterly.

DM-4. **Using Archived/Historical Data in Operations** – Historical traffic information can often be a vital input to several advanced traffic management applications.

NRO seeks to utilize available historical information (including travel times) to develop more efficient algorithms and procedures for network management.

5.3.10 Asset Management

Asset Management utilizes systematic approaches to the management of highway assets. This area includes refining and advancing the use of existing asset management systems and developing systems where they presently do not exist.

5.3.10.1 Overview

NRO has created a separate group dedicated to maintenance, installation and construction of technology field equipment including DMS, HAR, and traffic detectors. These activities will be supplemental to the activities carried out by the traditional maintenance and construction divisions within the VDOT NoVA District. A GIS database has been created with all of the operations technology field equipment. In addition, statewide, there is ongoing development of an integrated asset management system called Integrated Maintenance Management System (IMMS). This system is used to coordinate maintenance and construction activities statewide.

5.3.10.2 Strategies

The following strategies carry out asset management related activities:

AM-1. **Operations Technology Field Asset Coordination During Construction** – NRO plans to increase coordination with various groups internal and external to VDOT involved in construction to review affected operations technology field assets and minimize field device down time. NRO would also like to take advantage of ongoing construction activities to install new technology assets.

AM-2. **Maintain GIS Database of Technology Assets** – NRO will continue to maintain the recently created GIS-database of technology assets including identifying staff and protocol necessary for database maintenance and configuration control.

AM-3. **Traffic Signal Asset Management** – Traffic signals are probably the single most important asset that NRO has to manage on a daily basis. NRO is considering the installation of Uninterruptible Power Supply (UPS) systems and cabinet surge protectors throughout their signal network.

5.3.11 Enabling Activities

This area includes three categories of supporting, cross-cutting activity that enable and facilitate NRO in carrying out their mission, including pursuit of the strategies identified in the preceding ten program areas. These three areas include:

- Performance-based Management
- Standards Utilization
- Workforce development.

Each of these three areas is described and associated strategies are identified in the sections that follow.

5.3.11.1 Performance-based Management

This Strategic Plan provides many of the elements necessary for performance-based management, including a vision, mission, goals, objectives, and tracking measures for each objective. However, there are several very significant elements that are missing and which will take some considerable effort to implement. These elements are:

- Setting specific performance targets for each tracking measure (e.g., "reduce the number of crashes by 25% over the next four years"), collecting the necessary data, and analyzing it to monitor progress toward attaining the targets.
- Developing project-specific performance estimates and assessing the post-deployment performance of projects.
- Using estimated project performance in annual programming decisions and utilizing historic project performance results when revising strategic objectives, tracking measures, and performance targets.

As NRO moves towards a more performance-oriented management framework, it will leverage the relationships with local universities in monitoring performance. As NRO moves forward with performance-based management, it will also be important, where feasible, to express the intended and actual (post-deployment) impact of operations investments in dollar terms.

The following strategies carry out NRO performance-related activities:

EA-1. Develop and Monitor Performance Targets – For each of the objectives tracking measures presented in Section 4.4, a specific level of desired performance must be identified, along with a timeline for achieving that level. That process will likely include analysis of historic system performance data, analysis of forecasted travel demand, and analysis of customer feedback. All three dimensions will impact the setting of targets—how well have we done in the past, what level of demand will we need to accommodate in the future, and what level of performance will the public judge to be acceptable? After setting these targets, data must be collected and analyzed on a continuing basis and the results disseminated to appropriate parties. Data will come from a wide variety of sources, including the monitoring mechanisms implemented as part of specific projects (as required in strategy EA-2). Results will be used over time to further refine NRO strategic objectives, objective tracking measures, and performance targets.

EA-2. Develop and Track Project-Specific Evaluation Measures – Every project proposed for funding should include estimated impacts on NRO performance targets and include a long-term project monitoring plan. That plan should identify how post-deployment data will be collected and utilized to evaluate the project's performance. Once implemented, the performance of the project should be

evaluated and the results fed back into the operational strategy for the project and also fed into the database available to other project developers and to the annual project programming process.

EA-3. Utilize Project Performance in Programming Decisions – The annual project prioritization process should consider the estimated impacts of each proposed project and the ability to effectively evaluate those impacts once implemented. Once a good base of real-world data on the impacts of various types of NRO projects is obtained, that information must also be taken into account during the next Strategic Plan update to adjust performance targets and strategies as appropriate.

EA-4. Develop Benefit-Cost Tools and Staff Skills – In order to effectively prioritize projects and assess the extent to which they help meet performance targets, NRO staff must be skilled in applying appropriate benefit-cost analysis tools and techniques.

EA-5. ITS Decision Support Tool – NRO has developed a decision support tool to enable identification of technology-based strategies to solve operational problems. NRO will promote and integrate the use of the tool to identify solutions for bottlenecks on arterials and other safety and mobility related issues.

5.3.11.2 Standards Utilization

The USDOT Research and Innovative Technology Administration ITS standards program website (http://www.standards.its.dot.gov) identifies the following motivations and benefits associated with the use of standards in operations:

- Standards are open and non-proprietary and thereby help agencies avoid costly single-source procurements and locked-in maintenance relationships with vendors.
- Standards support the deployment of interoperable systems, helping agencies link together different types of operations technologies and making system expansions easier to plan and implement.
- Standards are being developed for many different types of technologies and their use is being supported by the USDOT through technical assistance programs, training, and deployment outreach and guidance.
- Using ITS standards in project deployment is a key aspect of conformity with the Federal Highway Administration Rule on ITS Architecture and Standards.

The following strategies carry out NRO standards related activities:

EA-6. Utilize Appropriate Standards – It is the responsibility of NRO project developers to be familiar with, and utilize as appropriate, various operations technology standards on a project-by-project basis. Those standards include national ITS standards as well as any applicable VDOT statewide or NRO-specific standards. The NRO ITS Architecture provides project developers with a logical starting point for considering standards. The architecture identifies a

subset of potentially applicable standards for each information exchange in the architecture. The maturity of different standards varies and project developers will need to consult additional standards information resources to make their final decisions. Extensive information on the status of over 100 national ITS standards is available on the USDOT standards program website: http://www.standards.its.dot.gov/. Specific NRO staff will be charged with monitoring the development of national and statewide standards and developing guidance on how those standards should be utilized in NRO projects and systems.

5.3.11.3 Workforce Development

In an era of increasing opportunities, rapidly shifting political realities, technology improvements, and an aging workforce, recruiting and retaining a talented workforce is a strategic challenge. In addition to recruitment, workforce needs and planning are often relegated to the sidelines while agencies focus on their core missions. Typically, state departments of transportation have focused workforce development activities primarily on construction and maintenance activities. As the role of VDOT has expanded to include transportation systems management and operations, development and maintenance of a skilled and qualified operations workforce is critical. This area addresses the "people-side" of NRO and focuses on developing and retaining a motivated, talented, and diverse workforce with the capabilities necessary to carry out the strategies identified in the other program areas.

Guided by the federal, state-level and district-level efforts in this area, NRO is taking a proactive approach to workforce development by focusing on initiatives for recruitment, retention, staff development, change management, and succession planning. Most activities relating to workforce development are driven by district-level or statewide initiatives. However, as the NRO workforce becomes more specialized and technology-oriented, it is important to identify NRO-specific needs and strategies and reflect them in hiring and procurement practices to get the right people at the right time in the right places.

The following strategies carry out workforce development related activities:

EA-7. **Technical Training Program** – This project supports the VDOT Commissioner's objective for workforce development by instituting a training program that will help the NRO workforce keep current in the face of changing requirements and evolving technologies. New, different, and upgraded skill sets are needed to manage and operate the new technologies. There is also a need for a technical resource library. An initial activity will be to assess current training needs among NRO personnel. The training program will take advantage of existing forums available to VDOT such as VDOT University, which currently does not have specialized requirements for transportation system management and operations technologies. NRO can also enable its staff to take advantage of online training opportunities such as those provided by the Consortium for ITS Training and Education and will leverage opportunities to receive training from vendors.

EA-8. **Internship and Associates Programs** – Participation of NRO staff in existing district and statewide programs will help expose students to a wide-variety of career options within NRO. NRO should be more aggressive in participating in Career Days in the high school and college level to explain the kind of career path and jobs that are available within NRO.

EA-9. **NRO-wide Workforce Planning Exercise** – This activity will include multiple section managers and will identify near-term and long-term needs and skill sets. The workforce planning exercise will result in more realistic and coordinated hiring practices while keeping in mind future operations.

EA-10. **Project Management Training** – Create and administer a training program that will provide NRO staff the project and contract management skills necessary to successfully manage complex technology projects with large teams of consultants and vendors. State rules for project and contract requirements are complex and NRO staff need to be trained to successfully manage projects to an on-time and on-budget outcome.

EA-11. **Survey NRO Employees** – Develop an internal survey of employees to maintain internal communications, improve efficiencies, assess employee morale, identify improvements, and reduce turnover.

EA-12. **Enhanced Safety Procedure Training** – Improve and enhance the efficacy of training of safety procedures for field staff.

EA-13. **Encourage SWAM businesses Participation in NRO Projects** – NRO will encourage the participation of SWAM businesses as a part of the procurement decisions

VI. Future Directions

This chapter focuses on factors that have influenced the NRO strategic direction described in the previous chapters and which are expected to have a continuing and probably greater impact in the near future. This chapter also identifies NRO research needs, some of them related to these trends and influences. Tracking these trends and influences and researching their impact on NRO and how NRO can best address them will be an important on-going activity and will inform updates of this NRO Strategic Plan.

6.1 Trends and Influences Impacting NRO Long Term Strategy

The range of factors that impact the context and challenges faced by NRO in coming years is immense and it is not possible to predict the future. However, it is useful to consider some of the most significant trends and influences which are likely to most impact NRO in the future. The summary of trends/influences and their potential implications presented in Table 6.1 reflect a review of a number of recent national transportation reports and activities, including:

- The USDOT's 2008 report, "*Refocus. Reform. Renew. A New Transportation Approach for America*."
- The Transportation Research Board's 2005 report, "*Critical Issues in Transportation*."
- The American Association of State Highway and Transportation Officials' 2007 "*Report on Long-Term Financing Needs for Surface Transportation."*
- The National Surface Transportation Policy and Revenue Study Commission's 2007 Final Report, "*Transportation for Tomorrow*."
- The USDOT Research and Innovative Technology Administration's 2008 report, "*Transportation Vision for 2030: Ensuring Personal Freedom and Economic Vitality for a Nation on the Move*."
- USDOT's 2007 report "*Five-Year ITS Program Plan*."
- Various materials, including the July 31-August 31, 2008 Meeting Minutes, from the USDOT Research and Innovative Technology Administration's "ITS Program Advisory Committee website (http://www.its.dot.gov/itspac/index.htm).

Trends/Influences and Potential Implications		
Trend/Influence	**Summary**	**Implications**
National Transportation Funding Crisis	The USDOT and many industry groups like the American Association of State Highway Transportation Officials (AASHTO) agree that this country faces a transportation funding crisis of unprecedented proportions and that major changes to transportation financing and other approaches will be needed.	• Increasing competition for funding resources, including increased pressure to be accountable for the performance of NRO investments • Competition between traditional construction projects and operations projects for funding will increase the need for methods with which to fairly comparing operations and traditional projects • Increasing emphasis on performance management and performance-based funding • Increasing need to articulate the intended and actual impacts of investments in dollar terms (which resonate with the public and policy makers) • Increasing need for skills and tools to support benefit-cost analysis and life cycle cost analysis • Possibly increasing reliance on user fees, including traditional tolling and innovative approaches such as mileage-based user fees • Increasing pressure and opportunities to partner with the private sector
USDOT Emphasis on Congestion Pricing Strategies	USDOT is increasingly encouraging states and regions to utilize roadway pricing strategies to combat traffic congestion.	• Potentially greater VDOT and NRO focus on High Occupancy Tolling Lanes and/or variably priced tolling
USDOT Focus on Accident Reduction as Core of New Program	The Administrator of the USDOT RITA has issued a “challenge goal” of reducing the vehicle crash rate by 90% by 2030. The RITA program is being reorganized around this goal.	• Ability to link projects with safety benefits will be increasingly important
USDOT Emphasis on Integrated Roadway and Transit Strategies	This is driven in part by the movement toward roadway congestion pricing, which increases the need for integration across modes.	• Emphasis on Corridor/ Congestion Management strategies (Program Area 2) such as C/CM-6, “Integrated Corridor Management.”
Evolution of the National Vehicle Infrastructure Integration (VII) Program	The direction of the USDOT program has shifted dramatically recently to emphasize safety and vehicle-to-vehicle rather than vehicle to roadside communications.	• Focus on ways to tap the stream of vehicle-to-vehicle information and assume that roadside infrastructure-intensive data sources are unlikely within the next 5 or even 10 years
Greater Emphasis on “Data-Driven” Approaches to Improving Safety	In addition to traditional safety program activities, there is an increased focus on utilizing existing and new data sources to craft solutions to pinpoint specific hotspots and causes. USDOT would place	• Need to effectively gather and archive data, including ways to take advantage of VII-derived data • Need for systems to support data mining and analysis.

Trends/Influences and Potential Implications		
Trend/Influence	**Summary**	**Implications**
	greater emphasis on data quality in their proposed enhancements to the Federal Highway Safety Improvement Program.	
Increasing Focus on Aging Roadway Infrastructure	A key component of the overall crisis in transportation funding is the enormous financial demands associated with America's rapidly deteriorating roads and bridges.	• Need to effectively monitor the condition of transportation assets • Greater emphasis on strategies to prolong the life of transportation assets
Increasing Focus on the Link Between Transportation and Environmental Quality	Global warming and other factors have increased the attention paid to the link between transportation and the environment.	• Greater need for data, tools and staff skills related to understanding the environmental impacts of NRO investments and activities
Increasing Freight Activity	A variety of factors are driving increases in freight activity, including globalization and changes in logistical practices.	• Increasing need for data, tools and staff skills related to understanding how freight is impacted by, and impacts transportation system performance • Greater relative emphasis on freight considerations when prioritizing investments • Greater emphasis on facilitating intermodal linkages
Increasing Focus on Speeding the Process of Transportation Investment	With widespread agreement that the United States faces massive transportation investment needs, there is an accompanying recognition of the need to facilitate investment by streamlining and accelerating the entire transportation planning and implementation process	• Increased pressure to streamline and accelerate development and implementation of NRO projects
Increasing Competition for Qualified Technical Staff	As USDOT and state and local agencies increase their use of advanced technology systems, shortages of qualified technical staff will be amplified.	• More vigorous approaches to attracting and retaining qualified staff • Increased emphasis on "growing" qualified staff from within and training to keep them qualified
Growth in the market for private sector participation in traveler information	There has been a growth in the market for private navigation systems bolstered by availability of new technologies as well as private sector traffic (probe) data. This will lead to a fully private supply chain for traveler information into the vehicle.	• What role does NRO play in the new emerging paradigm for traveler information? • Will the new methods of traveler information impact NRO activities?

Table 6.1 – Trends/Influences and Potential Implications

6.2 NRO Research Needs

The trends and influences identified in Table 6.1 suggest a number of issues that NRO will be tracking, researching, and preparing for over the next several years. For example, given the state of the national transportation funding system, it should be a

priority for NRO to continue to research and experiment with alternative funding mechanisms such as tolls, private sector partnerships, or mileage-based user fee structures. Additional direction on NRO research needs comes from the Virginia Transportation Research Council System Operations Research Advisory Committee (SORAC) annual research prioritization process.

From among approximately 26 candidate research topics under consideration by SORAC for FY09, NRO has identified the topics shown in Table 6.2 as their ten highest priorities. Several of these topics are related to strategies identified in Chapter V and the research and strategies should be coordinated, e.g., rolling the research in as an initial phase of a specific project/strategy or linking a project/strategy deployed in the field such that the results are fed back to the broader research effort.

High Priority Research Topics	
Topic	**Examples of Specific Questions to be Considered**
Active Traffic Management Best Practices and Benefits for NRO	• Potential benefits of increased ramp metering in NRO? • Applications to improve flow where two major traffic streams converge (e.g., Dulles Toll Road entering onto Eastbound I-66)? • Use of hard shoulders for travel lanes? • Use of queue warning systems?
Best Practices for Dynamic Message Signs	• Message lengths, wording, and format? • Use of colors and symbols?
Evaluation of Work Zone Traffic Management Strategies	• NRO includes several large construction projects that would provide an opportunity to evaluate the impact of various work zone strategies and assumptions from the associated Transportation Management Plans. • Impact on mode choice? Impact on traffic delay and flow?
Evaluation of a Integrated Freeway-Arterial Street Diversion Route	• Before-after analysis of benefits • Evaluate value of additional ramp detection that, when an incident on the freeway is detected, could trigger a special arterial street timing plan
Best Practices for Building a Sustainable Workforce for Operations	• How to attract and retain qualified staff?
Guidelines for the Utilization of Simulation Models	• What models should be used for what applications? • Guidelines for data quality and input assumptions
Consistent Application of Performance Measures for Incident Management & Emergency Response	• What measures can be utilized consistently across projects and groups?
Interoperability among VDOT Transportation Operations Centers	• What level of interoperability among centers is needed or optimal? • How can interoperability best be achieved, including through a statewide ITS architecture?
Vehicle Infrastructure Integration	• Given the latest direction in the USDOT program and the activities of the private sector, what should NRO be doing in the area of VII? • Are there opportunities to participate in current testing activities? • Should a demonstration project be launched in NRO?
Modeling Disaster Scenarios	• Determine the impact of losing one of the various critical links in the transportation system and evaluate various response and recovery strategies

Table 6.2 – High Priority Research Topics

VII. NRO Planning and Programming Process

The NRO Planning and Programming Process is the link between the strategies listed in this plan and the projects that will be prioritized, funded, and implemented on an annual basis. Since 2007, NRO has implemented a fully integrated "cradle to grave" project programming process for traffic systems operations and management. This program, one of the leading examples of planning for operations around the country, enhances NRO's ability to make sound investment decisions among competing priorities in a resource-constrained environment. The process, developed by NRO's Planning & Programming Section, unifies strategic and tactical planning, project generation, investment analysis, budgeting, performance tracking, and reporting / feedback to the NRO management team.

Figure 7.1 below describes the NRO planning and programming process and the timelines with respect to NRO's fiscal year (July to July).

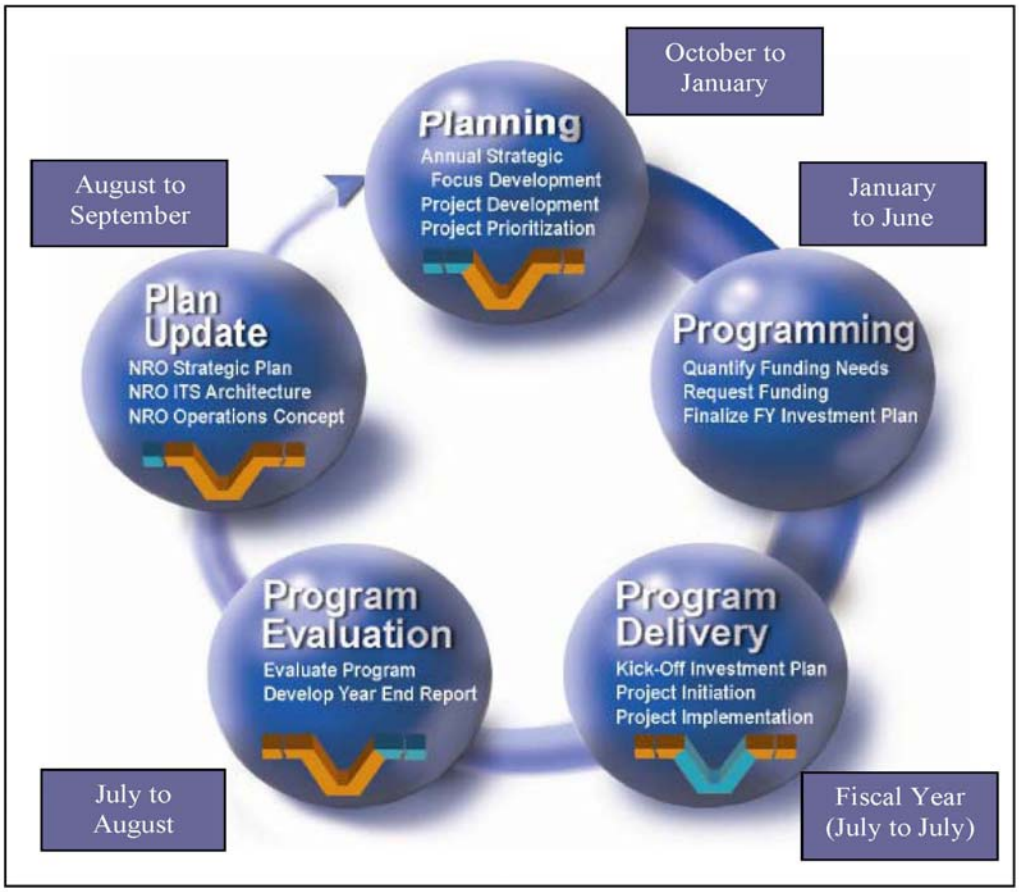

Figure 7.1 – NRO Planning and Programming Process

The planning phase is guided by this document and the NRO Regional Architecture. These serve as the strategic direction for specific project and program ideas and proposals. The project ideas, described in a standard format, are then compiled annually and evaluated jointly by NRO Section Managers. The project ideas are

evaluated according to multiple criteria including performance measures, to rank-order potential investments.

As the last part of the planning phase, rank-ordered projects are overlaid against available funding (primarily based on the prioritization model but also taking advantage of available funding opportunities) to develop an Investment Plan for the fiscal year. This process is summarized in Figure 7.2.

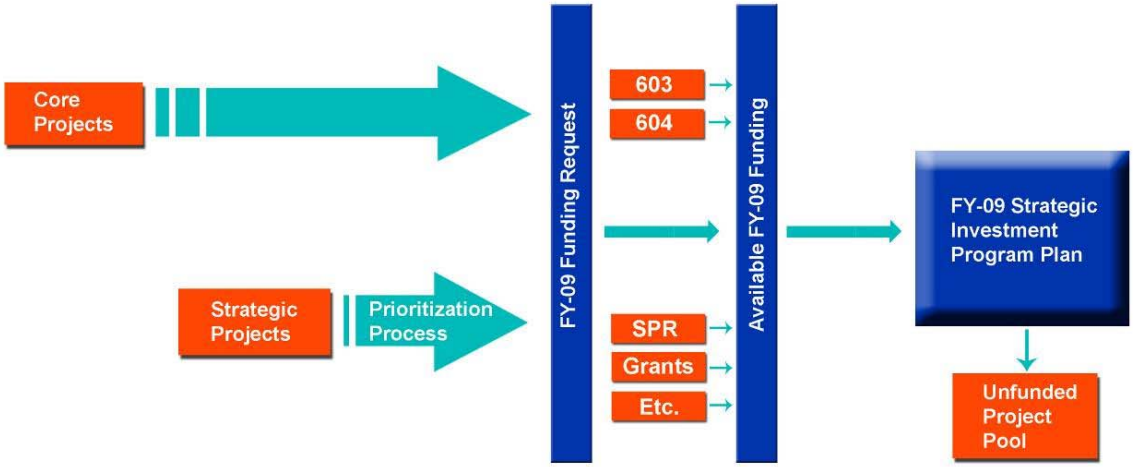

Figure 7.2 – Funding Plan Development Process

In the programming phase, funding requests are developed based on the Investment Plan. Individual project requests are drafted and submitted for each funding source available to NRO. The funding request is sent to the VDOT Central Office (and the State Transportation Board) for assessment and approval.

Once the funding request is approved, as the first step in project delivery, NRO schedules a kick-off meeting to begin activities identified in the Investment Plan. At this stage, depending on funding allocations, decisions on scope and schedules are considered. Availability of funding or lack thereof may also adjust project prioritization. Unfunded projects are removed and these ideas are saved for re-prioritization and funding requests in the subsequent years.

Since 2007, NRO has focused on project delivery enhancements with a renewed institutional emphasis on the use of systems engineering and a life-cycle approach to project delivery. NRO requires the development of a Concept of Operations for each of the funded technology projects. Ongoing enhancements to this process include closer tracking of technical as well as fiscal performance during project implementation.

Project evaluations are vital to document the progress towards strategic goals and objectives. The evaluations serve as input to the NRO Year-End report which summarizes the activities of the fiscal year. By measuring project outputs and outcomes, NRO can update their strategic priorities and keep their regional architecture current for the next fiscal year, bringing the planning and programming process full circle.

VIII. Where to Go For More Information

Additional information on this Strategic Plan and the NoVA Regional Architecture can be obtained by:

1. Contacting:

   James Witherspoon
   Virginia Department of Transportation
   Northern Region Operations
   Planning and Programming
   703-383-2582
   james.witherspoon@vdot.virginia.gov

2. Consulting the NRO Regional Architecture website:

   http://www.vdot-itsarch.com/Default.htm

Appendix A

Map of NRO Strategies to Goals and Objectives

Strategies by Program Area

Objectives (by Goal area)		1. Traveler Information								2. Corridor/Congestion Mangement										
Goal	Objective	TI-1: Device Master Planning and Project Development	TI-2: Travel Times on DMS and 511	TI-3: DC Region Traveler Information Efforts	TI-4: Portable Technologies for Construction Zones	TI-5: Traveler Information Kiosks and Displays	TI-6: Real-Time Multi-modal Traveler Information	TI-7: Regionally Disseminated Real-Time Park and Ride Info.	TI-8: Alternative Data Collection and Fusion Approaches	C/CM-1: Device Master Planning and Project Development	C/CM-2: Advanced Traffic Management System (ATMS) Replacement	C/CM-3: Traffic Signal Retiming	C/CM-4: Traffic Signals Master Planning	C/CM-5: Coordination of Traffic Operations with HOT Lanes	C/CM-6: Integrated Corridor Management	C/CM-7: Bottleneck Mitigation Program	C/CM-8: Access Management	C/CM-9: Active Traffic Management on Key Corridors	C/CM-10: Travel Demand Management	C/CM-11: Parking Management
Goal 9: Enhance & Develop NRO Workforce Capabilities	d - Reduce workplace accidents																			
	c - Attract and retain a diverse talented workforce																			
	b - Support and sustain a learning environment for NRO staff																			
	a - Enhance workforce needs planning to prepare for the future operations																			
Goal 8: Improve Regional Ops.Coord. & Efficiency	c- Improve day to day information sharing with regional operations partners			x				x						x	x			x	x	
	b- Improve operations planning with regional operations partners			x																
	a - Include ITS/Operations in all relevant construction projects				x															
Goal 7: Improve the NRO Business Process	e - Minimize project cost and schedule overruns																			
	d - Utilize equal employment opportunity practices in hiring and procurement decisions																			
	c - Make performance-based decisions																			
	b - Make the rationale for all NRO investments clear and consistent																			
	a - Minimize operations planning, programming, and project delivery time																			
Goal 6: Improve Emergency Mgt.	b - Reduce vulnerability of critical NRO assets to security risks																			
	a - Improve coordination of regional emergency management	x								x	x									
Goal 5: Preserve & Manage an Integrated Traffic Mgt. Sys.	b - Improve information gathering on freeways and arterials			x	x				x		x		x	x	x					
	a - Maintain field infrastructure so that it operates reliably	x								x	x		x							
Goal 4: Promote Environ. Resp.	a - Reduce energy consumption and environmental costs of transport operations						x	x				x			x				x	x
Goal 3: Enhance Comm. w/ Travelers	a -Provide proactive, timely, and accurate information and responses to the traveling public.	x	x	x	x	x	x	x	x	x										
Goal 2: Improve Safety	b - Reduce pedestrian and bicyclist crashes																			
	a - Reduce vehicular crashes															x				
Goal 1: Reduce Congestion	e - Reduce incident clearance times	x								x	x				x			x		
	d - Reduce delays due to work-zones and planned special events	x			x					x									x	
	c - Actively manage travel demand on NRO facilities		x	x		x	x	x							x		x	x	x	x
	b - Improve travel time reliability on major corridors	x	x							x		x	x	x	x	x		x	x	
	a - Reduce travel times and delays for all modes along identified major corridors	x								x	x	x	x	x	x	x		x	x	x

Objectives (by Goal area)		3. Emergency Management						4. Incident Management											
Goal	Objective	EM-1: Regional Evacuation Route Management	EM-2: TOC as Incident Command Post	EM-3: Public Information Protocols for Emergency Management	EM-4: Enhanced Use of Evacuation Planning Analysis Tools	EM-5: Investigate Critical Infrastructure Monitoring Technologies	EM-6: Field Equipment and Cabinet Security Enhancement	IM-1: Device Master Planning and Project Development	IM-2: Formal Command & Control	IM-3: Continue CAD Integration	IM-4: Expand and Modernize Safety Service Patrol (SSP) Program	IM-5: Transition to Public Safety and Transportation Operations Center (PSTOC)	IM-6: Regional Incident Data Sharing	IM-7: Establish Northern Virginia Incident Management Group	IM-8: Expand Law Enforcement Traffic Signal Pre-emption	IM-9: Automatic Incident Detection	IM-10: Establish a Coordinated Efficient Clearance Program	IM-11: Automated Coordination of Traffic Signals During Incidents	IM-12: Integrate Incident Management Plan with ATMS
Goal 9: Enhance & Develop NRO Workforce Capabilities	d - Reduce workplace accidents																		
	c - Attract and retain a diverse talented workforce																		
	b - Support and sustain a learning environment for NRO staff																		
	a - Enhance workforce needs planning to prepare for the future operations																		
Goal 8: Improve Regional Ops.Coord. & Efficiency	c- Improve day to day information sharing with regional operations partners	x	x							x		x	x						
	b- Improve operations planning with regional operations partners		x									x	x						
	a - Include ITS/Operations in all relevant construction projects																		
Goal 7: Improve the NRO Business Process	e - Minimize project cost and schedule overruns																		
	d - Utilize equal employment opportunity practices in hiring and procurement decisions																		
	c - Make performance-based decisions																		
	b - Make the rationale for all NRO investments clear and consistent																		
	a - Minimize operations planning, programming, and project delivery time																		
Goal 6: Improve Emergency Mgt.	b - Reduce vulnerability of critical NRO assets to security risks					x	x												
	a - Improve coordination of regional emergency management	x	x	x	x			x	x	x	x	x	x	x		x	x		x
Goal 5: Preserve & Manage an Integrated Traffic Mgt. Sys.	b - Improve information gathering on freeways and arterials												x			x			
	a - Maintain field infrastructure so that it operates reliably							x		x	x	x							
Goal 4: Promote Environ. Resp.	a - Reduce energy consumption and environmental costs of transport operations																		
Goal 3: Enhance Comm. w/ Travelers	a -Provide proactive, timely, and accurate information and responses to the traveling public.			x				x			x		x						
Goal 2: Improve Safety	b - Reduce pedestrian and bicyclist crashes																		
	a - Reduce vehicular crashes																		
Goal 1: Reduce Congestion	e - Reduce incident clearance times		x					x	x	x	x	x	x		x	x	x		x
	d - Reduce delays due to work-zones and planned special events							x					x						
	c - Actively manage travel demand on NRO facilities												x						
	b - Improve travel time reliability on major corridors							x			x								
	a - Reduce travel times and delays for all modes along identified major corridors							x			x						x	x	

Objectives (by Goal area)		5. Road Weather Mgt.				6. Safety and Incident Prevention						7. Reg. & State-wide Coord.			8. Construc. & Work Zone Mgt.		
Goal	Objective	RWM-1: Automated Anti-Icing Systems	RWM-2: Expand RWIS Network	RWM-3: Snow and Ice Mobilization Plans	RWM-4: Weather Responsive Traffic Management (WRTM)	SIP-1: Overheight Detection System	SIP-2: Pedestrian Countdown Signals	SIP-3: Speed Harmonization	SIP-4: Weather Related Warning Systems	SIP-5: Queue warning and disabled vehicle alarm on managed lanes	SIP-6: Traffic Engineering Strategies	RSC-1: Planning Coordination	RSC-2: Continued Participation in MATOC Development	RSC-3: VA Traffic Integration	CWM-1: Transportation Management Plan (TMP) Development and Implementation	CWM-2: Advanced Technology Applications in Highway Construction Zones	CWM-3: Lane Closure Advisory Management System (LCAMS)
Goal 9: Enhance & Develop NRO Workforce Capabilities	d - Reduce workplace accidents																
	c - Attract and retain a diverse talented workforce																
	b - Support and sustain a learning environment for NRO staff																
	a - Enhance workforce needs planning to prepare for the future operations																
Goal 8: Improve Regional Ops.Coord. & Efficiency	c- Improve day to day information sharing with regional operations partners												x	x		x	
	b- Improve operations planning with regional operations partners											x	x	x	x	x	
	a - Include ITS/Operations in all relevant construction projects											x			x	x	
Goal 7: Improve the NRO Business Process	e - Minimize project cost and schedule overruns																
	d - Utilize equal employment opportunity practices in hiring and procurement decisions																
	c - Make performance-based decisions																
	b - Make the rationale for all NRO investments clear and consistent																
	a - Minimize operations planning, programming, and project delivery time											x					
Goal 6: Improve Emergency Mgt.	b - Reduce vulnerability of critical NRO assets to security risks																
	a - Improve coordination of regional emergency management	x	x	x	x								x	x			
Goal 5: Preserve & Manage an Integrated Traffic Mgt. Sys.	b - Improve information gathering on freeways and arterials							x						x	x	x	
	a - Maintain field infrastructure so that it operates reliably		x	x										x			
Goal 4: Promote Environ. Resp.	a - Reduce energy consumption and environmental costs of transport operations														x		
Goal 3: Enhance Comm. w/ Travelers	a -Provide proactive, timely, and accurate information and responses to the traveling public.				x	x			x	x							
Goal 2: Improve Safety	b - Reduce pedestrian and bicyclist crashes						x										
	a - Reduce vehicular crashes	x			x	x		x	x	x	x						
Goal 1: Reduce Congestion	e - Reduce incident clearance times													x			
	d - Reduce delays due to work-zones and planned special events													x	x	x	x
	c - Actively manage travel demand on NRO facilities							x								x	
	b - Improve travel time reliability on major corridors	x			x			x								x	
	a - Reduce travel times and delays for all modes along identified major corridors				x			x								x	

Objectives (by Goal area)		9. Data Mgt.				10. Asset Mgt.			11. Enabling Activities												
Goal	Objective	DM-1: Freeway Performance Monitoring System	DM-2: NRO Dashboard	DM-3: Quarterly Report on NRO System Performance	DM-4: Using Archived/Historical Data in Operations	AM-1: ITS Field Asset Coordination During Construction	AM-2: Maintain GIS Database of ITS Assets	AM-3: Traffic Signal Asset Management	EA-1: Develop and Monitor Performance Targets	EA-2: Develop and Track Project-specific evaluation measures	EA-3: Utilize Project Performance in Programming Decisions	EA-4: Develop Benefit-Cost Tools and Skill Sets	EA-5: ITS Decision Support Tool	EA-6: Utilize Appropriate Standards	EA-7: Technical Training Program	EA-8: Internship and Associates Program	EA-9: NRO-wide Workforce Planning Exercise	EA-10: Project Management Training	EA-11: Survey NRO Employees	EA-12: Enhance Safety Procedures Training	EA-13: Encourage SWAM participation on NRO projects
Goal 9: Enhance & Develop NRO Workforce Capabilities	d - Reduce workplace accidents																			x	
	c - Attract and retain a diverse talented workforce														x	x	x		x		
	b - Support and sustain a learning environment for NRO staff														x	x	x				
	a - Enhance workforce needs planning to prepare for the future operations														x	x	x		x		
Goal 8: Improve Regional Ops.Coord. & Efficiency	c- Improve day to day information sharing with regional operations partners																				
	b- Improve operations planning with regional operations partners																				
	a - Include ITS/Operations in all relevant construction projects																				
Goal 7: Improve the NRO Business Process	e - Minimize project cost and schedule overruns																	x			
	d - Utilize equal employment opportunity practices in hiring and procurement decisions																				x
	c - Make performance-based decisions	x	x	x					x					x							
	b - Make the rationale for all NRO investments clear and consistent									x	x	x									
	a - Minimize operations planning, programming, and project delivery time																				
Goal 6: Improve Emergency Mgt.	b - Reduce vulnerability of critical NRO assets to security risks																				
	a - Improve coordination of regional emergency management																				
Goal 5: Preserve & Manage an Integrated Traffic Mgt. Sys.	b - Improve information gathering on freeways and arterials				x																
	a - Maintain field infrastructure so that it operates reliably					x	x	x													
Goal 4: Promote Environ. Resp.	a - Reduce energy consumption and environmental costs of transport operations																				
Goal 3: Enhance Comm. w/ Travelers	a -Provide proactive, timely, and accurate information and responses to the traveling public.												x								
Goal 2: Improve Safety	b - Reduce pedestrian and bicyclist crashes												x							x	
	a - Reduce vehicular crashes												x								
Goal 1: Reduce Congestion	e - Reduce incident clearance times												x								
	d - Reduce delays due to work-zones and planned special events					x							x								
	c - Actively manage travel demand on NRO facilities												x								
	b - Improve travel time reliability on major corridors												x								
	a - Reduce travel times and delays for all modes along identified major corridors				x					x			x								

Appendix B

Program Area Linkages to NRO Regional Architecture

1. Traveler Information
The market packages most associated with traveler information include the following:

- Broadcast Traveler Information (see http://www.vdot-itsarch.com/Marketpackages/ATIS1.htm)
- Interactive Traveler Information (see http://www.vdot-itsarch.com/Marketpackages/ATIS2.htm)
- In-Vehicle Signing (see http://www.vdot-itsarch.com/Marketpackages/ATIS9.htm)

2. Corridor/Congestion Management
The market packages most associated with corridor/congestion management include the following:

- Network Surveillance (http://www.vdot-itsarch.com/Marketpackages/ATMS01.htm)
- Probe Surveillance (http://www.vdot-itsarch.com/Marketpackages/ATMS02.htm)
- Freeway Control (http://www.vdot-itsarch.com/Marketpackages/ATMS04.htm)
- HOV Lane Management (http://www.vdot-itsarch.com/Marketpackages/ATMS05.htm)
- Traffic Information Dissemination (http://www.vdot-itsarch.com/Marketpackages/ATMS06.htm)
- Regional Traffic Control (http://www.vdot-itsarch.com/Marketpackages/ATMS07.htm)
- Traffic Forecast and Demand Management (http://www.vdot-itsarch.com/Marketpackages/ATMS09.htm)
- Reversible Lane Management (http://www.vdot-itsarch.com/Marketpackages/ATMS18.htm)
- Speed Monitoring (http://www.vdot-itsarch.com/Marketpackages/ATMS19.htm)
- Multimodal Coordination (http://www.vdot-itsarch.com/Marketpackages/apts7.htm)

3. Emergency Management
The market packages most associated with emergency management include the following:

- Emergency Call-Taking and Dispatch (http://www.vdot-itsarch.com/Marketpackages/em01.htm)
- Emergency Routing (http://www.vdot-itsarch.com/Marketpackages/EM02.htm)

- Transportation Infrastructure Protection (http://www.vdot-itsarch.com/Marketpackages/EM05.htm)
- Wide-Area Alert (http://www.vdot-itsarch.com/Marketpackages/EM06.htm)
- Early Warning System (http://www.vdot-itsarch.com/Marketpackages/EM07.htm)
- Disaster Response and Recovery (http://www.vdot-itsarch.com/Marketpackages/EM08.htm)
- Evacuation and Reentry Management (http://www.vdot-itsarch.com/Marketpackages/EM09.htm)
- Disaster Traveler Information (http://www.vdot-itsarch.com/Marketpackages/EM10.htm)

4. Incident Management
The market packages most associated with incident management include the following:

- Incident Management (http://www.vdot-itsarch.com/Marketpackages/ATMS08.htm)
- Roadway Service Patrols (http://www.vdot-itsarch.com/Marketpackages/EM04.htm)
- Emergency Call-Taking and Dispatch (http://www.vdot-itsarch.com/Marketpackages/em01.htm)
- Hazmat Management (http://www.vdot-itsarch.com/Marketpackages/CVO10.htm)

5. Road Weather Management
The market packages most associated with road weather management include the following:

- Road Weather Data Collection (http://www.vdot-itsarch.com/Marketpackages/MC03.htm
- Weather Information Processing and Dissemination (http://www.vdot-itsarch.com/Marketpackages/MC04.htm)
- Roadway Automated Treatment (http://www.vdot-itsarch.com/Marketpackages/MC05.htm)
- Winter Maintenance (http://www.vdot-itsarch.com/Marketpackages/MC06.htm)

6. Safety and Incident Prevention
Currently, there are no market packages in the regional architecture directly addressing this topic.

7. Regional and Statewide Coordination
Currently, there are no market packages in the regional architecture directly addressing this topic.

8. Construction and Work Zone Management
The market packages most associated with construction and work zone management activities include the following:

- Roadway Maintenance and Construction (http://www.vdot-itsarch.com/Marketpackages/MC07.htm)
- Work Zone Management http://www.vdot-itsarch.com/Marketpackages/MC08.htm)
- Maintenance and Construction Activity Coordination (http://www.vdot-itsarch.com/Marketpackages/MC10.htm)
- Roadway Closure Management (http://www.vdot-itsarch.com/Marketpackages/ATMS21.htm)

9. Data Management
The market package associated with archived data management is:

- ITS Data Mart (http://www.vdot-itsarch.com/Marketpackages/datamart.htm)

10. Access Management
Currently, there are no market packages in the regional architecture directly addressing this topic.

11. Enabling Activities
Currently, there are no market packages in the regional architecture directly addressing this topic.