Summary Report

Northern Virginia District (NOVA)
Smart Travel Program

Virginia Department of Transportation

December 1999

VDOT Technical Manager:
Amy Tang
NOVA District
Smart Travel Program Manager

Technical Support:
PB Farradyne Inc.
Odetics ITS

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EXECUTIVE SUMMARY

Technology applications that improve the delivery of transportation services are known as Intelligent Transportation Systems (ITS). The Virginia Department of Transportation's (VDOT) Smart Travel Program unifies the ITS applications of all transportation modes and levels of government under one umbrella concept—Smart Travel. VDOT recognizes that ITS cannot be developed in isolation; ITS is systems, and systems require a high degree of coordination for effective development. The Smart Travel Program provides the needed coordination.

Purpose of this Summary Report

This report presents the short-term recommended list of Smart Travel projects for the Northern Virginia District (NOVA.) NOVA's Smart Travel planning process is an ongoing effort that includes reviews by staff and stakeholders to refine the strategic plan for the development of the region's ITS. The planning process is summarized by the following reports, which can be referred to for more detailed information:

- The *Strategic Plan* identifies future operations in NOVA and outlines the systems necessary for their support;
- The *Summary of 1999 Activities* identifies the current status of the district's Smart Travel Program;
- The *Mapping of Ten Smart Travel Systems to Vision* flows from the *Strategic Plan* and includes a recommended set of long-range ITS projects.

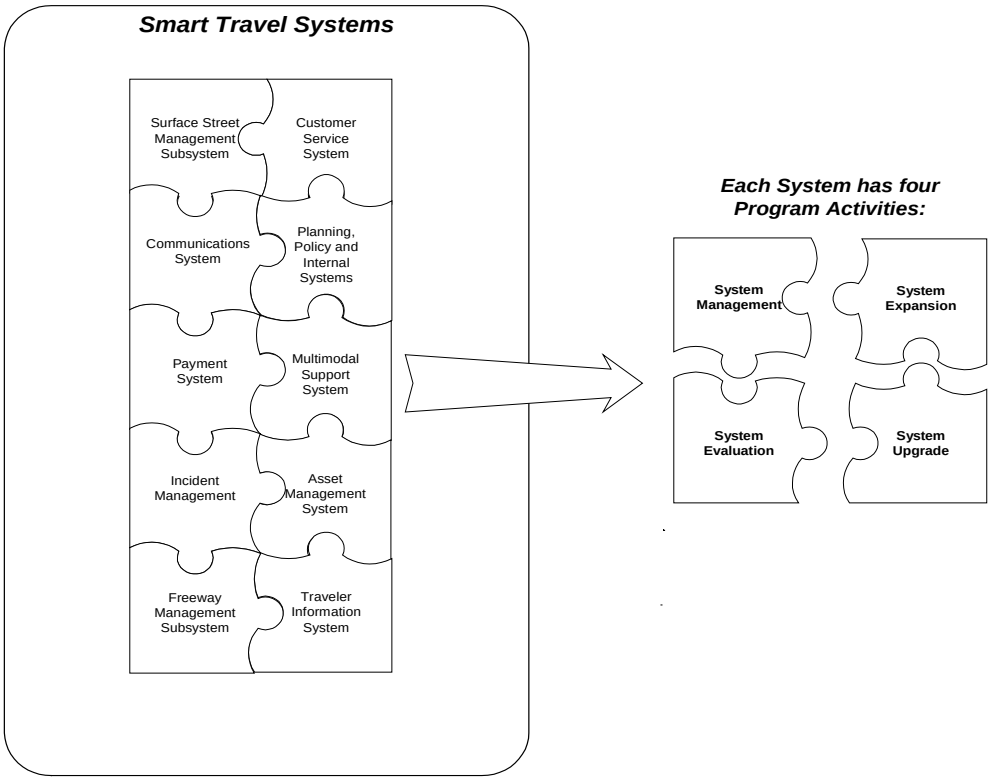
This Summary Report integrates the findings of all of these activities and reports into a single document. It presents both a long-range set of actions and a short-range (two-year) set of projects, and describes the strategic planning process used in their development.

Planning for ITS - Building Systems

Planning for ITS is somewhat different from planning for typical transportation infrastructure. Computers, communications and software are complex and their underlying technology is rapidly advancing. Also, they are notoriously difficult to change or modify once in place. Because it is so difficult to modify technology systems, ITS planning must be sufficiently detailed to ensure that the ITS installed today has the capability designed into the original systems for future expansion. NOVA's Smart Travel Program does just that. It envisions the future transportation service needs, including the geographic and functional needs, and envisions complete ITS systems to meet those needs. The NOVA Smart Travel Program can be described as ten inter-related systems that work together. Like pieces in a puzzle, the ten systems are related and form the complete picture of Smart Travel in NOVA. The following table and graphic summarize the concepts of the ten Smart Travel systems.

NOVA Smart Travel Systems	
System	**Purpose**
Planning and Policy	The planning and policy system is largely made up of internal policy and planning processes to ensure the consideration of all ITS alternatives, and that proposed systems are consistent with the overall local, regional and statewide transportation framework. Smart Travel planning and policy projects are continuous activities that respond to changes in technology, strategic priorities, or business practices. Further, the planning and policy system evaluates deployments to determine their effectiveness and contribution to the strategic planning initiatives.
Surface Street Management	The surface street management system enables comprehensive management of critical arterial roads within NOVA. While NOVA maintains signals on the primary routes in the region, other jurisdictions operate and maintain some secondary roadways. Projects in this system ensure regional coordination to optimize traffic flow during peak periods, incidents, and special events.
Freeway Management	The freeway management system monitors and operates the freeway system at its optimal level. Effective freeway management will provide raw data to improve traveler information while allowing real-time operational adjustments as traffic conditions demand.
Incident Management	The incident management system enables VDOT to identify the occurrence and nature of roadway or roadside incidents, initiate an appropriate response, and clear the incident in a timely manner.
Multi-modal Support	The multi-modal support system provides travelers with information on alternate modes of transportation. The intent of this system is to distribute a broad range of modal information, allowing travelers to choose the most appropriate mode available and decreasing travel demand on the highway system.
Customer Service	The customer service system provides a direct link between travelers and VDOT services. The system provides VDOT with feedback on customer satisfaction and allows management to target resources in response to customer demands.
Communications	All Smart Travel systems that transfer information require wireline and/or wireless communication. This system establishes the required communications infrastructure that enables the other systems to inter-operate, taking into account service requirements and implications on cost, performance and user acceptance.
Traveler Information	The traveler information system encompasses the broad range of services that provide traveler information to the public, with the goal of improved travel choices, reduced delay, and improved customer satisfaction.
Asset Management	The asset management system coordinates routine VDOT maintenance and operations activities in a way that minimizes travel disruptions.
Payment System	The payment system involves electronic toll collection, transaction confirmation, and payment violation. In addition, this system enables the integration of toll collection with other electronic payment systems in the region.

THE TEN SMART TRAVEL SYSTEMS



The Smart Travel program directly addresses the need for planning and coordination in system development. VDOT does not deploy Smart Travel projects as a set of unrelated technologies; the value of ITS is greatly increased when data from various systems is shared between them to enable a variety of different applications – improving the delivery of transportation services.

Inter-Regional Operations

Smart Travel provides the intelligent link between travelers, vehicles, and infrastructure and enables people and goods to move more safely and efficiently through a state-of-the-art, inter-modal transportation system—regardless of whom operates the transportation infrastructure. For example, Advanced Traveler Information Systems (ATIS) can provide seamless information for an entire region, regardless of the agency or entity operating individual elements of the system.

Smart Travel envisions an interconnected, statewide ITS to meet the state's travel needs. This statewide network will be built on a foundation of local (district and residency) ITS. ITS, just like other traffic operations, are delivered at the local level. The statewide vision builds on the local ITS deployments to create a statewide network. Four multi-regional/district Smart Travel centers

are planned statewide, with NOVA's existing center planned as one of these multi-regional centers. Each district will be directly connected to one of the four centers. Residencies can choose to connect or not, based on their needs. Districts will be connected to the statewide network through their connections with their Smart Travel center.

Traffic problems ignore departmental boundaries, and Smart Travel facilitates address inter-district operations. NOVA's Smart Travel program includes operations across district boundaries, specifically I-66 west to I-81 and I-95 south to the city of Fredricksburg. Operating these roadways from the NOVA Smart Travel Center makes sense in terms of both finance and logistics. Financially, it is more efficient to operate these roadways from NOVA than to invest in additional control centers. These roadways are also of critical importance for traffic through and connecting with the Capital region from Maryland and Virginia, and NOVA is the logical jurisdiction to manage these interconnections.

National ITS Architecture Consistency

The NOVA Smart Travel Program planning process will also help ensure VDOT NOVA maintains their eligibility for federal ITS funds. The recent TEA-21 federal transportation bill included a requirement that agencies demonstrate "consistency" with the National ITS Architecture to be eligible for federal funds for ITS. The Federal Highway Administration (FHWA) defines ITS as any project with advanced technology such as telecommunications, computers, sensors, etc. The National ITS Architecture is a system engineering tool that describes computer systems. It helps ensure that ITS is deployed across the nation using a common framework and that future ITS can be linked and integrated to maximize the ITS investment.

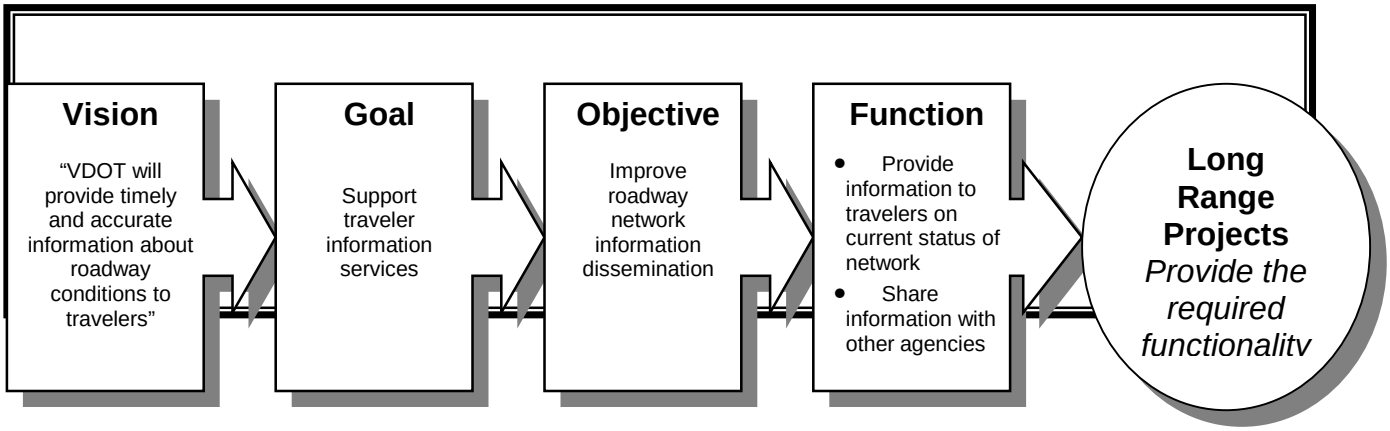
Strategic Planning and Project Selection Process

NOVA's Smart Travel program was developed using a system engineering process that mirrored the strategic process for the statewide Smart Travel program. This top-down approach describes the vision, goals, objectives and functions that support holistic systems development.

The vision portrays the services Smart Travel can provide to enhance the efficiency of the transportation network. The vision was developed based on several regional studies, the statewide Smart Travel Business Plan, the Northern Virginia Early Deployment Plan and VDOT's Strategic Plan for the 21st Century. Also, the vision is consistent with two Washington, DC area plans: the National Capital Region Transportation Planning Board's *Vision, Goals, Objectives and Strategies*, and the Washington Council of Governments' *Proposal for a Metropolitan Washington Area ITS Transportation Management System Showcase.* Goals are then derived, which provide initial direction on how to proceed toward the vision. Many goals are directly connected to on-street safety and operations needs. Objectives further clarify goals and provide a more specific direction that is used to define functions. Selected functions are

aggregated to define projects. This logical hierarchy allows any project to be traced back to the goals and objectives, ensuring consistency with the state Smart Travel program, as well as other long-range planning documents.

Importantly, the "functions" of the Smart Travel program are equivalent to the user service requirements of the National ITS Architecture. Thus, the Smart Travel planning process that defines the required functionality of the regional system relates directly to the user services of the National ITS Architecture. This relationship ensures consistency with the National ITS Architecture, as required for federal-aid eligibility.



AN EXAMPLE FROM THE NOVA SMART TRAVEL STRATEGIC PLANNING PROCESS

Defining the Long Range Program

The long-range program recommends projects by comparing the functions revealed by the strategic planning process to the functions accommodated by the current systems in Northern Virginia. Identification of the "gap" between current deployment and the functions envisioned by the Strategic Plan provides the long-range project list. Like pieces of a puzzle, the district can identify and implement projects that complete the desired functionality of the system.

Ranking Projects for the Short Range Program

This report summarizes the results of a criteria-based process to develop a recommended list of short-range projects. The process considered:

- Smart Travel elements of road and highway projects identified in the regional transportation plan.
- Maintaining and operating the existing Smart Travel systems.
- Planning and evaluation projects in support of Smart Travel.
- Safety projects.
- Projects on a critical path that enables further system development.
- In addition, placeholders were included for two reasons:
    - The regional planning process can produce projects in the short-term program; the placeholders consider ITS elements that emerge from the short-term program.
    - Accommodate opportunities or to meet unique needs that arise.

Smart Travel Program – Long-Range and Short-Range Projects

The following table lists the long-range and short-range program of projects. The projects noted in **bold** are recommended for implementation in the short-term. Each project is classified based on which of the ten Smart Travel systems it supports, and each is further classified as System Management, System Expansion, System Upgrade, and/or System Evaluation based on the following definitions:

- System Management refers to the task of operating, maintaining and managing the system's functionality.
- System Expansion refers to projects that increase the geographic coverage of a system.
- System Upgrade refers to the task of adding functionality to a system.
- The Smart Travel program also includes a periodic System Evaluation of each project. This work will help guide future implementation strategies for new system elements.

The table on the following page lists the entire program of projects, with the short-range projects in **bold** typeface. Primary system contributions are denoted by a solid symbol (●), and secondary system contributions are denoted by a hollow symbol (○).

SMART TRAVEL PROGRAM PLAN
LONG RANGE AND SHORT-RANGE PROJECTS

Projects	Smart Travel System										Project Type			
	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Smart Travel Integration and Standards Guidelines	●	○	○	○	○	○	○	○	○	○	●	○		
Congestion Mapping System	●	○	○	○							○		●	
Operations and Management Planning	●	○	○	○	○	○	○	○	○	○	●			○
Decision Support System for Resource Sharing Initiatives	●						○				●			○
Smart Travel (GIS) Inventory System	●										○		●	
Professional Capacity Building	●	○	○	○	○	○	○	○	○	○	●			○
Traffic Data Archiving System	●	○	○								○		●	
Smart Travel Program Outreach	●										●	○		
Decision Support for Smart Travel Implementations	●											●	○	
Smart Travel Strategic Planning	●										●		○	
Coordination with Six-Year Improvement Program	●										○	●		
Deployment Tracking	●										○			●
Smart Travel Spot Safety Project Ranking Criteria	●	○	○	○	○	○	○	○	○	○	●			○
Technical Support to Dulles Toll Road Technology Task Group	●		○		○						●		○	
Regional Signal Coordination		●									●	○		
Signal Priority for Transit/Emergency Vehicles		●			○						○		●	
Traffic Signal System Field Maintenance		●									●			○

Bold type indicates that the project is recommended for inclusion in the Short-Range Plan.

● - Indicates a principal function for the project.
○ - Indicates a supportive function for the project.

SMART TRAVEL PROGRAM PLAN
LONG RANGE AND SHORT-RANGE PROJECTS

Projects	Smart Travel System										Project Type			
	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Traffic Control Software Maintenance		●									●		○	
Traffic Control Software/ Hardware Upgrade		●									○		●	
Real-Time Traffic Adaptive Control System (RT-TRACS) Implementation		●										●		○
Signal System Evaluation	○	●											○	●
Traffic Control Communication Study	○	●					○					○		●
Integration of Developer-installed Signals with Smart Travel		●									○	●		
Red Light Running Cameras		●									○	●		
Head-on Traffic Warning System and Evaluation	●	●									○	●		○
De-icing System Evaluation		●									○	●		○
Automated Pedestrian Safety System		●									○	●		
Bicyclist Safety Enhancement		●									○	●		
Grade Crossing Safety Enhancement		●									○	●		
Spot Safety Project Placeholder		●									○	●		
Freeway Access Control System		○	●								●		○	
Integrated Traffic Management		○	●								●		○	
Integration of Signal, Freeway and Safety Service Patrol (SSP) Operations		○	●	○								○	●	
Analysis of Traffic Management Needs	○		●								●			○
Evaluation of Cellular Call Locating System	○		●	○			○	○			○			●
Transponders as Probes			●	○			○	○		○		○	●	
Smart Traffic Center Software and Hardware Maintenance			●								●			○

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SMART TRAVEL PROGRAM PLAN
LONG RANGE AND SHORT-RANGE PROJECTS

Projects	Smart Travel System										Project Type			
	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Co-locate Smart Traffic Center, Smart Signal Control Center, and SSP Operations Control		○	●	○							●		○	
Freeway Management System Evaluation	○		●										○	●
Freeway System Completion Projects			●	○			○	○			○	●		
Road and Highway Projects in the Regional Long-Range Plan			●	○			○	○			○	●		
Interstate System Completion Project Placeholder			●	○			○	○			○	●		
Roadway Maintenance Operations Link to TCC		○		●					○		●		○	
AVL for Safety Service Patrol			○	●								○	●	
Workzone Safety System				●							●			○
Uniform Incident Response Protocol Implementation				●							●			○
Low Cost Route Diversion Study	○	○		●							●			○
Mayday System				●							●			○
Uniform Incident Response and Dispatch Protocol Update				●									●	○
Lessons Learned From Construction Impact Mitigation Strategies	○			●							○			●
Springfield Interchange Smart Travel Implementation				●		○		○				●	○	
Woodrow Wilson Bridge Smart Travel Implementation				●		○		○				●	○	
Transportation Demand Management Support	○				●						○		●	
Evaluation of Support to Transit Operations	○				●							○		●
Customer Service Enhancement						●					○		●	

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SMART TRAVEL PROGRAM PLAN
LONG RANGE AND SHORT-RANGE PROJECTS

Projects	Smart Travel System										Project Type			
	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Transportation Communications Center Operations Upgrade		○	○	○		●					●		○	
Emergency Call Services Upgrade						●							●	○
Customer Satisfaction Survey	○					●					○			●
Inventory of Communications Infrastructure	○						●						○	●
Fiber-Optic Link between I-66 and the Northern Virginia District Headquarters							●					●	○	
Procedures for Maintaining the Communication Infrastructure	○						●				●			○
Districtwide Communications System Evaluation	○						●					○		●
Parking Information System					○			●					●	○
Enhanced Traveler Information System					○			●					●	○
Regional Traveler Information System Recompete					○			●			●	○		
Evaluation of the Regional Traveler Information System	○							●			○			●
Enhanced AVL for Snow Plows									●		○		●	
Regionwide Coordination with Construction/Road Closures	○								●		●	○		
AVL for Fleet Management									●			●		○
Evaluation of AVL for Fleet Management	○								●		○			●
Integrated Payment System					○					●		○	●	
Toll Operations Improvements			○							●		○	●	
Evaluation of Integrated Payment System	○									●			○	●
Project Placeholder—Unforeseen Opportunities														

Bold type indicates that the project is recommended for inclusion in the Short-Range Plan.

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Program Cost Overview

The implementation cost of Smart Travel projects is more than $38 million, with annual operating and maintenance costs exceeding $5.9 million. While these numbers might first appear to be substantial, they are a fraction of the $1.5 billion for infrastructure construction in Northern Virginia budgeted for the next ten years (the Northern Virginia 2020 Transportation Plan identified a need for more than $10 billion in projects over the next 20 years). Moreover, the benefits of efficient system management provide a more than an adequate return on investment, while contributing to social goals such as safety and quality of life. Finally, the vast majority the funding for these projects will come as part of larger construction/reconstruction of existing infrastructure, such as the Woodrow Wilson Bridge and Springfield Interchange reconstruction projects.

Smart Travel System	Capital or Implementation Cost*	Annual Operation/Maintenance or Personal Services Cost**
Planning and Policy	$ 910,000	$ 0
Surface Street Management	$ 2,320,000	$ 1,152,000
Freeway Management	$ 23,300,000	$ 3,664,000
Incident Management	$ 11,000,000	$ 1,110,000
Multi-modal		
Customer Service		
Communications	$ 1,100,000	
Traveler Information		
Asset Management		
Payment	$ 250,000	
Total:	**$ 38,880,000**	**$ 5,926,000**

* *Capital or Implementation Cost* includes the one-time cost of implementing or executing a project.
** *Annual Operation/Maintenance or Personal Services Cost* is the yearly cost to maintain and operate the system, including hardware, software and personal services expenses. Where exact data was unavailable, it was assumed that these annual expenses would be 10% of the system's implementation cost.

Next Steps

This document will now be circulated as a draft to undergo review by executive staff. Once approved for consistency with VDOT strategic direction and policies, the document will be used to guide short-term funding decisions. Smart Travel planning is a continuous process, and the document will undergo updates to reflect new developments in technology, funding and deployment.

ACRONYMS

ATIS	Advanced Traveler Information System
AVL	Automated Vehicle Location, as commonly enabled by global positioning systems.
CCTV	Closed Circuit Television
CMAQ	Congestion Mitigation and Air Quality Improvement Program, a federal surface transportation funding program
FCC	Federal Communications Commission
GIS	Geographic Information System
HAR	Highway Advisory Radio
HOV	High Occupancy Vehicle lanes
ITS	Intelligent Transportation System or Systems
NHS	National Highway System, a designated system of federal highways, and an associated federal surface transportation funding program
NOVA	Northern Virginia District of the Virginia Department of Transportation
NTCIP	National Transportation Communications for ITS Protocol
STC	Smart Traffic Center, operated by VDOT
STP	Surface Transportation Program, a federal surface transportation funding program
TEA-21	Transportation Equity Act for the 21st Century, the federal authorizing legislation for surface transportation.
VDOT	Virginia Department of Transportation
VMS	Variable Message Signs
WWB	Woodrow Wilson Bridge

PURPOSE

The Virginia Department of Transportation's (VDOT) Intelligent Transportation Systems program is known as Smart Travel. This program has put VDOT at the forefront of ITS in the US, with projects installed in both urban and rural areas to meet Virginia's transportation needs. Smart Travel activities in the VDOT Northern Virginia District (NOVA) have been underway for at least a decade and include technology applications to support freeway management, traffic signal operations, maintenance, and safety.

This report summarizes and presents the results of VDOT NOVA's planning efforts for the future of Smart Travel in the district. It presents both a long-range set of actions and a short-range (two-year) set of projects. The process used to identify these actions and projects is also described.

The Smart Travel Program is important to VDOT's overall mission, which is highly customer-focused. ITS itself addresses specific customer issues such as safety, improving travel reliability, reducing delays due to incidents, improving response to maintenance needs, responding to customer inquiries, and adjusting signal timing to match real-time traffic demands. Employing technology to enable customer-oriented services brings with it certain policy issues. Most significant are the human and financial resource requirements of installing, operating and maintaining advanced technology systems. This Summary Report is intended to:

- **Identify Projects.** NOVA's Smart Travel planning process identifies an "end-state" of system functionality; by identifying this collection of systems, projects are identified that will contribute to the provision of the complete system.

- **Enable Consensus and Coordination.** The NOVA Smart Travel planning process is based on the input of a broad cross-section of district staff including staff in maintenance, construction, planning, administration, transit, and public information. Meetings with these groups garner input and develop consensus, with results reflected and recorded in a supporting document entitled the Smart Travel Strategic Plan. The process is ongoing, reflecting changes in program development and external factors.

- **Ensure Efficient Resource Allocation.** Funding levels do not allow the immediate completion of all Smart Travel projects in the district. The NOVA Smart Travel Program is logically planned to allocate resources in a way that maximizes initial benefits while creating a development plan for enhancements to the system. Importantly, the plan helps avoid duplication of efforts or the development of incompatible systems.

- **Provide Policy Support.** NOVA's Smart Travel Program is an extension of the state's Smart Travel Business Plan, ensuring consistency with the statewide strategic direction for ITS.

- **Demonstrate consistency with the National ITS Architecture**. Consistency will ensure eligibility for federal aid. The NOVA Smart Travel Program is an extension of the state's ITS strategic plan, which was developed with strict adherence to National ITS Architecture guidelines.

OVERVIEW

The VDOT Northern Virginia District (NOVA) covers Arlington, Fairfax, Loudoun, and Prince William Counties. The area's transportation system, however, has important connections to other major population centers and transportation routes. Therefore, in addition to transportation facilities and services in NOVA, Smart Travel planning includes I-66 west to I-81 and I-95 south to the Fredricksburg city limit. Operating these roadways under NOVA's jurisdiction carries financial and operating efficiencies. Financially, it is more efficient to operate these roadways from NOVA than to invest in additional control centers. And since these roadways are of critical importance for traffic through and connecting with the Capital region, NOVA is the logical jurisdiction to manage these interconnections.

VDOT NOVA builds, maintains and operates freeways and primary roads within the district, and operates traffic signals throughout Fairfax, Loudoun, and Prince William Counties. There are numerous other units of local government within NOVA, which are responsible for operating and maintaining the secondary roads and providing emergency response services in their jurisdictions. In addition, Arlington and Alexandria operate and maintain the traffic signal systems within their jurisdictions. Finally, there are a number of agencies that have a stake in the region's transportation system, including transit, fire, and police agencies.

Planning ITS—a Systems Engineering Approach

In developing the Smart Travel long-range plan for VDOT NOVA, a systems engineering process was used that is consistent with the statewide Smart Travel planning process and helps ensure system integration. The process starts with a high level definition of the agency's Smart Travel vision, narrowing in focus through related goals, objectives and functions. Necessary functions are fulfilled by one or more actual projects. Thus, every project deployed in the region can be traced back to the goals and objectives, ensuring consistency with the state Smart Travel program, as well as other long-range planning documents.

Importantly, the "functions" of the Smart Travel program are equivalent to the user service requirements of the National ITS Architecture. Thus, the Smart Travel planning process that defines the required functionality of the regional system relates directly to the user services of the National Architecture. This relationship ensures consistency with the National Architecture, as required for federal-aid eligibility.

NOVA's Smart Travel planning process is reflected in various reports that are referenced throughout this Summary Report. The *Strategic Plan* identifies future operations in NOVA and outlines the systems necessary for their support. The *Summary of 1999 Activities* identifies the current status of the district's Smart Travel Program. Finally, the *Comprehensive Project List* flows from the *Strategic Plan,* and the *Program Plan* culls from this list the highest priority Smart Travel projects. This *Summary Report* integrates all of these reports and activities – visioning, long-range project list, short-range project list – into a single document.

Structure of This Summary Report

This report is organized in the following sections:

- Purpose – describes why this report was prepared.
- Overview – provides a descriptive framework of Smart Travel in NOVA focusing on groups of related Smart Travel projects that are deployed as systems.
- Status of Smart Travel in NOVA today – gives a foundation for the visioning process.
- The Strategic Plan: Vision, Goals, Objectives and Functions – outlines the systems engineering process and outcomes to identify the future of Smart Travel. It also helps reveal the gaps between the current and future Smart Travel systems in order to identify the activities required to achieve the vision.
- Long Range Program – A listing of actions, projects and groups of projects needed to fill the gaps in achieving the ITS Vision. The Program does not specifically list projects; for example, the long-range program may identify an action to install ITS on a segment of interstate. However, actually implementing that action may be accomplished in several steps or projects.
- Short Term Projects – The list of highest priority projects proposed for funding and implementation in the next two years.
- Program Cost Overview – An estimate of the implementation and annual operating costs of the Smart Travel Program in Northern Virginia.

DESCRIPTION OF THE NOVA SMART TRAVEL SYSTEMS

ITS is systems. That statement seems simple but conveys important concepts. First, VDOT does not deploy Smart Travel as a set of unrelated technologies. VDOT recognizes that the value of ITS is greatly increased if data from various systems can be shared among them to enable a variety of different applications. Second, ITS allows operations to cross institutional and jurisdictional boundaries—Smart Travel provides the intelligent link between travelers, vehicles, and infrastructure and enables people and goods to move more safely and efficiently through a state-of-the-art intermodal transportation system regardless who operates the transportation infrastructure. For example, Advanced Traveler Information Systems (ATIS) can provide seamless information for an entire region, regardless of the agency or entity operating individual elements of the system.

Operating ITS: Residencies and Districts

Smart Travel envisions an interconnected, statewide ITS to meet the state's travel needs. The purpose of a statewide network is to ensure seamless provision of ITS-supported transportation services across Virginia. In addition, statewide data sharing and emergency operational coordination can also be enabled by ITS.

This statewide network will be built on a foundation of local (district and residency) ITS. ITS, just like other traffic operations, is delivered at the local level. The statewide vision builds on the local ITS deployments to create a statewide network. Four multi-regional/district Smart Travel centers are planned statewide, with NOVA's existing center planned as one of these multi-regional centers. Each district will be directly connected to one of the four centers. Residencies can choose to connect or not, based on their needs. Districts and residencies will be connected to the statewide network through their connections with their Smart Travel center.

The Ten Smart Travel Systems

To help facilitate understanding of the Smart Travel program in NOVA, the following descriptions of the ten systems being installed were developed. The systems themselves interconnect and integrate into a single system—an overall region-wide ITS. Collectively, they will enable the district to realize the Smart Travel program vision. NOVA is building systems made up of complementary projects that relate to the overall Smart Travel vision; each system is an anchor to the NOVA Smart Travel program.

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System	**Purpose**
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Incident Management	The incident management system enables VDOT to identify the occurrence and nature of roadway or roadside incidents, initiate an appropriate response, and clear the incident in a timely manner.
Multi-modal Support	The multi-modal support system provides travelers with information on alternate modes of transportation. The intent of this system is to distribute a broad range of modal information, allowing travelers to choose the most appropriate mode available and decreasing travel demand on the highway system.
Customer Service	The customer service system provides a direct link between travelers and VDOT services. The system provides VDOT with feedback on customer satisfaction and allows management to target resources in response to customer demands.
Communications	All Smart Travel systems that transfer information require wireline and/or wireless communication. This system establishes the required communications infrastructure that enables the other systems to inter-operate, taking into account service requirements and implications on cost, performance and user acceptance.
Traveler Information	The traveler information system encompasses the broad range of services that provide traveler information to the public, with the goal of improved travel choices, reduced delay, and improved customer satisfaction.
Asset Management	The asset management system coordinates routine VDOT maintenance and operations activities in a way that minimizes travel disruptions.
Payment System	The payment system involves electronic toll collection, transaction confirmation, and payment violation. In addition, this system enables the integration of toll collection with other electronic payment systems in the region.

STATUS OF SMART TRAVEL SYSTEMS WITHIN NOVA

VDOT is known as a national ITS leader, and many systems have been operating in NOVA for several years. This section of the report describes the state of Smart Travel in NOVA today, including projects currently funded and underway. This provides a baseline of system deployment to use as a starting point in creating the set of long range actions needed to achieve the Smart Travel Vision. The ten systems described above serve as the basis for the discussion.

Planning and Policy System

The NOVA Smart Travel Plan provides guidance for implementing and evaluating Smart Travel deployment in the district. Cyclical work includes preparing and updating the NOVA Smart Travel Strategic Plan, developing an inventory of Smart Travel-related systems and activities (updated annually), and development of a Smart Travel project list and program plan for the district (updated biennially).

The Planning and Policy System also includes ad hoc planning studies for region- or technology-specific deployment within NOVA. Examples include the Dulles Corridor Technology Task Group to evaluate ITS technology for the corridor.

Surface Street Management System

The NOVA Smart Traffic Signal System became operational in 1998 and provides centrally coordinated operations and monitoring of more than 800 signalized intersections in the district. The signal system operation is being enhanced by the application of traffic flow optimization software.

NOVA is also the site of a federally sponsored demonstration of the Real-time Traffic Adaptive Control System (RT-TRACS). The system monitors traffic in real-time and adjusts signal timing to optimize traffic flow. The first phase included 16 intersections on the Reston Parkway; phase II is an evaluation of the system.

Freeway Management System

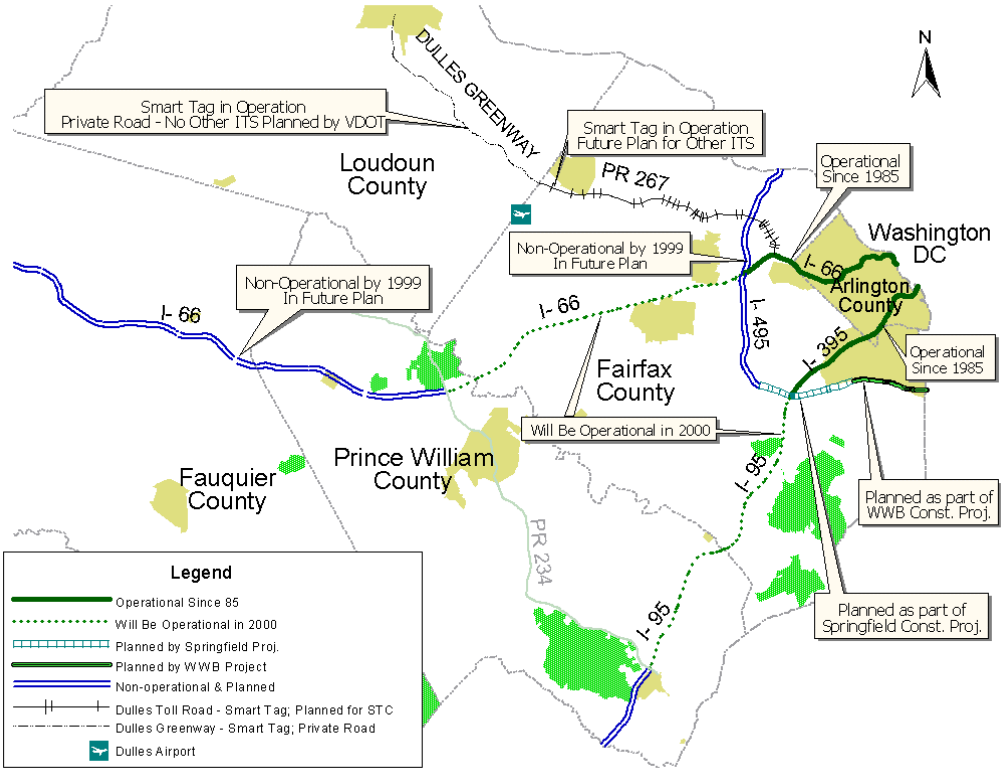
NOVA's Freeway Management System became operational in 1985 and is located in the Smart Traffic Center. Today, the Smart Traffic Center monitors and operates ITS on the 10-mile stretch of I-66 between the Capital Beltway and Roosevelt Bridge; the 11.5-mile segment of the Shirley Highway (I-395) between the Capital Beltway and 14th Street Bridge; and 10 miles of the Capital Beltway in the area of the Woodrow Wilson Bridge. In addition, the Center manages the HOV facilities of I-66, I-95, and I-395. Operations include:

- Traffic monitoring and management, including operation of ramp metering, variable message signs, CCTV, gate control of reversible lanes, and lane control for shoulder use during peak hour travel

- Equipment maintenance
- Communications
- Traffic information dissemination
- Incident Detection system

There are also specific "spot" Smart Travel deployments, such as the Truck Rollover Warning System, installed in 1994. The system, on I-495 at the I-95 southbound ramp and I-495 at the northbound Route 123 ramp, uses non-intrusive vehicle sensors with a video camera system and dynamic message sign to detect and warn fast approaching vehicles to slow for the sharp curves. Figure 1 illustrates the extent of the freeway management system in NOVA today.

Figure 1: NOVA Freeway Management System



Incident Management System

The incident management system is highly integrated with the freeway management system. The Smart Traffic Center provides all dispatching and two-way radio capability, highway advisory radio, and Smart Traffic Center data entry. Incident management includes the loop detection and CCTV used to detect incidents, the communications system used to notify appropriate response agencies, and the established protocols used by response agencies to secure the incident scene, manage traffic around the scene, and clear the incident to restore traffic flow.

Multi-modal Support System

Smart Travel's multi-modal support system is being applied to support incident management efforts in the busy Tyson's Corner area. There, the installation of CCTV monitors traffic and provides direct video link to the Smart Travel Center; this CCTV monitoring function could support the up-coming Dulles Corridor Bus Rapid Transit services. In the future, information from this system will be available to support the Washington Metropolitan Area Transit Authority's bus service.

Customer Service System

The original Transportation Operations Center, now known as the Transportation Communications Center, serves as NOVA's customer service information clearinghouse. The Center provides "one-stop shopping" for all inquiries. During snow emergencies, the Center operates 24 hours a day to provide road reports, manages snow and ice control activities, and communicates with the regional Council of Governments, the Fairfax County School District, and Fire and Police agencies.

Communications System

VDOT purchased a new digital telecommunications system, which is installed at the NOVA district office, residencies, and at several area headquarters. The system enhances VDOT's internal operating efficiency and customer service through its one-number service center, established in 1994.

VDOT has installed many miles of fiber optic communications trunks to enable field system communications to central control locations, and to connect the various central control systems together. VDOT intends to enter into a statewide shared resources agreement with a private sector partner that will enable increased system communications in the field.

Traveler Information System

Partners-in-Motion is one of the most publicly visible components of the regional traveler information system. Partners-in-Motion is a public-private partnership formed to implement comprehensive traveler information service in the DC metropolitan region. VDOT serves as the public contracting agency for the effort. The Traveler Information Center was launched in 1997, with Smart Traveler TV debuting in early 1998. In late 1998, the partnership launched AutoTraffic, a web site providing real-time traffic information on the Internet.

Asset Management System

VDOT is undertaking an aggressive asset management program known as the Inventory and Condition Assessment System (ICAS). The system will provide a "center line" inventory of all fixed assets on the state highway system right-of-way. Features of ICAS include GIS location system, pavement assessment, data "scrubbing" to ensure accuracy/utility, quality assurance/quality control of data.

VDOT has installed very limited asset management Smart Travel applications. It is a new area of technology applications for VDOT. A recent operational test, "Smart Plow," is an automatic vehicle location system (AVL), used for real-time tracking and management of snowplows. The system provides a color-coded map to show plow locations and status of snow and ice removal efforts. VDOT is also experimenting with AVL on safety service patrol vehicles, providing real-time location of the assets while aiding in incident location and response. VDOT will evaluate these and other asset management systems for their ability to improve overall operating efficiency.

Payment System

The Dulles Toll Road has had an electronic toll collection system operational since April 1996. The system, known as Smart Tag, was fully integrated with toll systems on the Powhite Parkway and the Powhite extension in the Richmond area, which joined the Smart Tag system in 1999. The Smart Tag store in NOVA also supports the system.

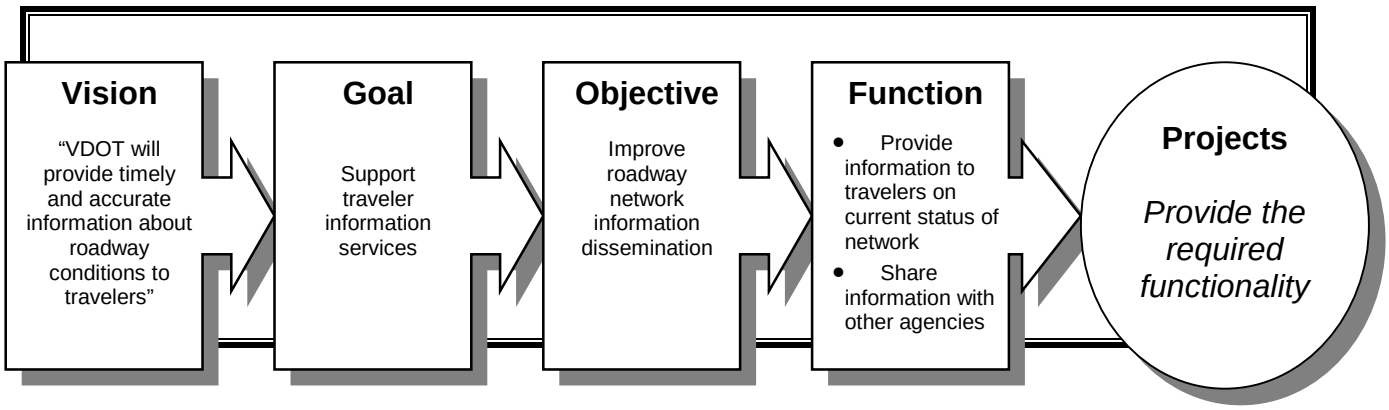
In addition to Smart Tag deployments in the area, there is a study underway focusing on regional seamless electronic payment services. The study, being performed by the Volpe National Transportation Systems Center, a research organization within the U.S. Department of Transportation, will educate and advise regional decision-makers on the benefits of an integrated payment system and the steps required for regional coordination.

THE STRATEGIC PLAN: VISION, GOALS, OBJECTIVES, AND FUNCTIONS

The NOVA Smart Travel Strategic Plan guides development of the Smart Travel program. The plan describes a future-state for Smart Travel deployment, using a top-down approach to identify vision, goals, objectives and functions. The visioning process incorporates and complements other regional transportation planning efforts. The National Capital Region Transportation Planning Board's vision statement and the Metropolitan Washington Area Intelligent Transportation Systems Showcase (the Wolfe Report) guide Smart Travel deployment in the greater Washington region. NOVA's vision also follows the guidance of the statewide Smart Travel program.

The NOVA Smart Travel vision encompasses 10 years and is one product of a process that maps goals, objectives and functions—functions that are fulfilled by the implementation of Smart Travel projects. This systematic process enables strategic program development, as projects can be traced back to the region's vision for Smart Travel.

Figure 2: The Smart Travel Strategic Planning Process



NOVA Smart Travel Vision Statement

The Smart Travel vision for NOVA, as motivated by VDOT's purpose and mission statements, is:

> "Applied transportation technology will help VDOT optimize its services, supporting a multi-modal transportation system that improves quality of life and customer satisfaction by ensuring safer and less congested roads."

From this district-wide vision statement flow more focused visions that center around two operational areas: System Management and Travel Information Services. The two areas are complementary, and the division between them can blur as Smart Travel deployments can service

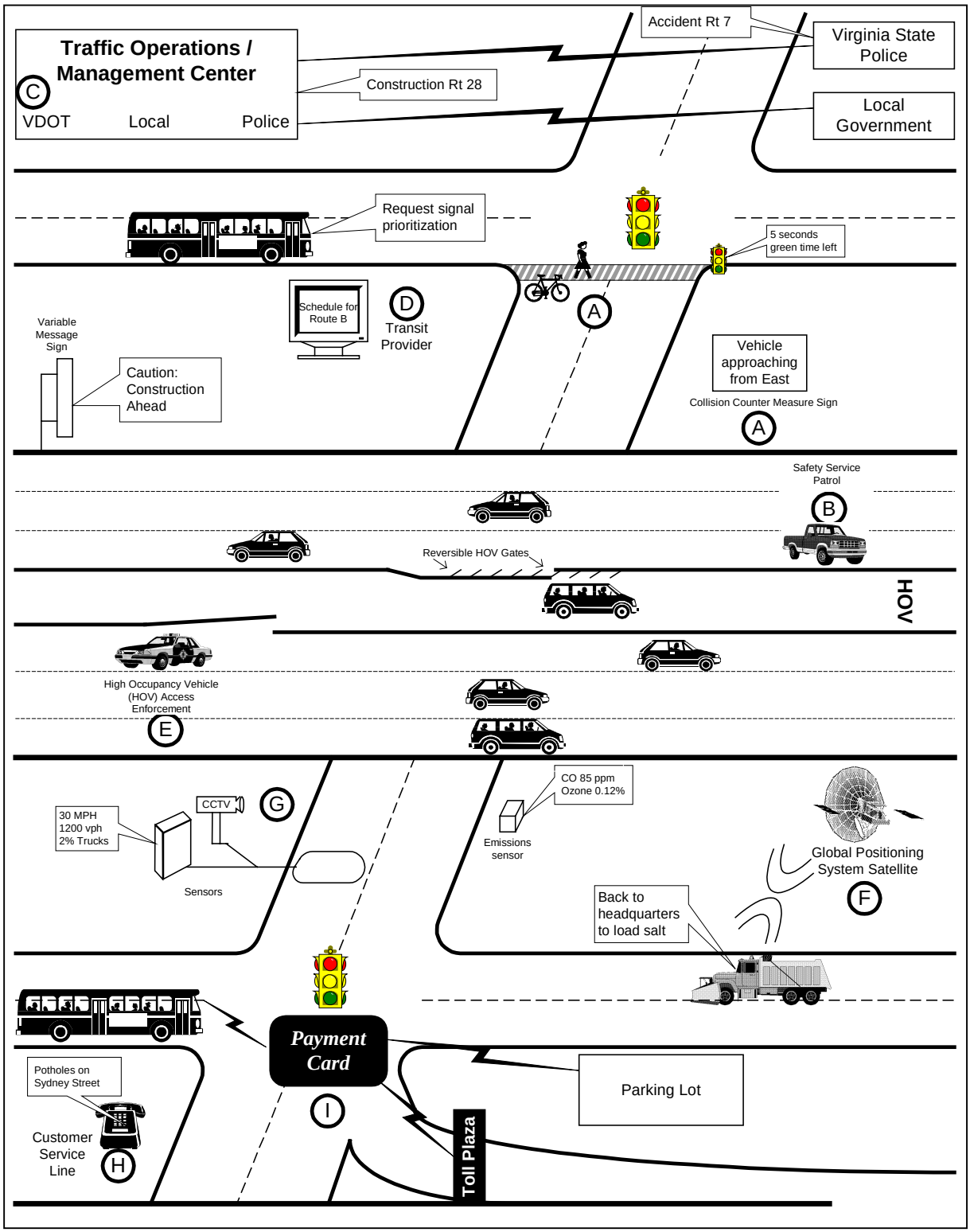
both. Basically, "System Management" services benefit the public agencies that build, maintain, enforce, and operate surface transportation facilities, by improving efficiency and effectiveness. "Travel Information Services" beneficiaries refer to the end users of the transportation system—e.g., drivers, transit riders, etc.

Vision Statements for System Management

Figure 3 on the next page provides a representation of the vision for the integration of transportation systems and services that provide quality system management (lettered statements below refer directly to the graphic.) Specific vision statements for the system are that VDOT will:

A. Improve the safety of travelers by providing advance warning, by implementing crash countermeasures, and by contributing to the security of transportation facilities.
B. Contribute to the prevention of secondary crashes by supporting prompt reporting and quick response to incidents.
C. Achieve more effective operations through real-time traffic surveillance and management
D. Support transit operators to improve transit services through real-time transit information and improved schedule adherence
E. Enhance the access control to the High Occupancy Vehicle (HOV) lanes and use systems to help prevent crashes on reversible HOV lanes
F. Optimize its operations by adopting automated processes to manage personnel, equipment and resources
G. Share field data within the Department and with other agencies to maximize the utility of the data
H. Provide enhanced customer service through prompt response and follow through to customer comments and issues
I. Support a simplified method of payment for transportation services

Figure 3: Vision for System Management

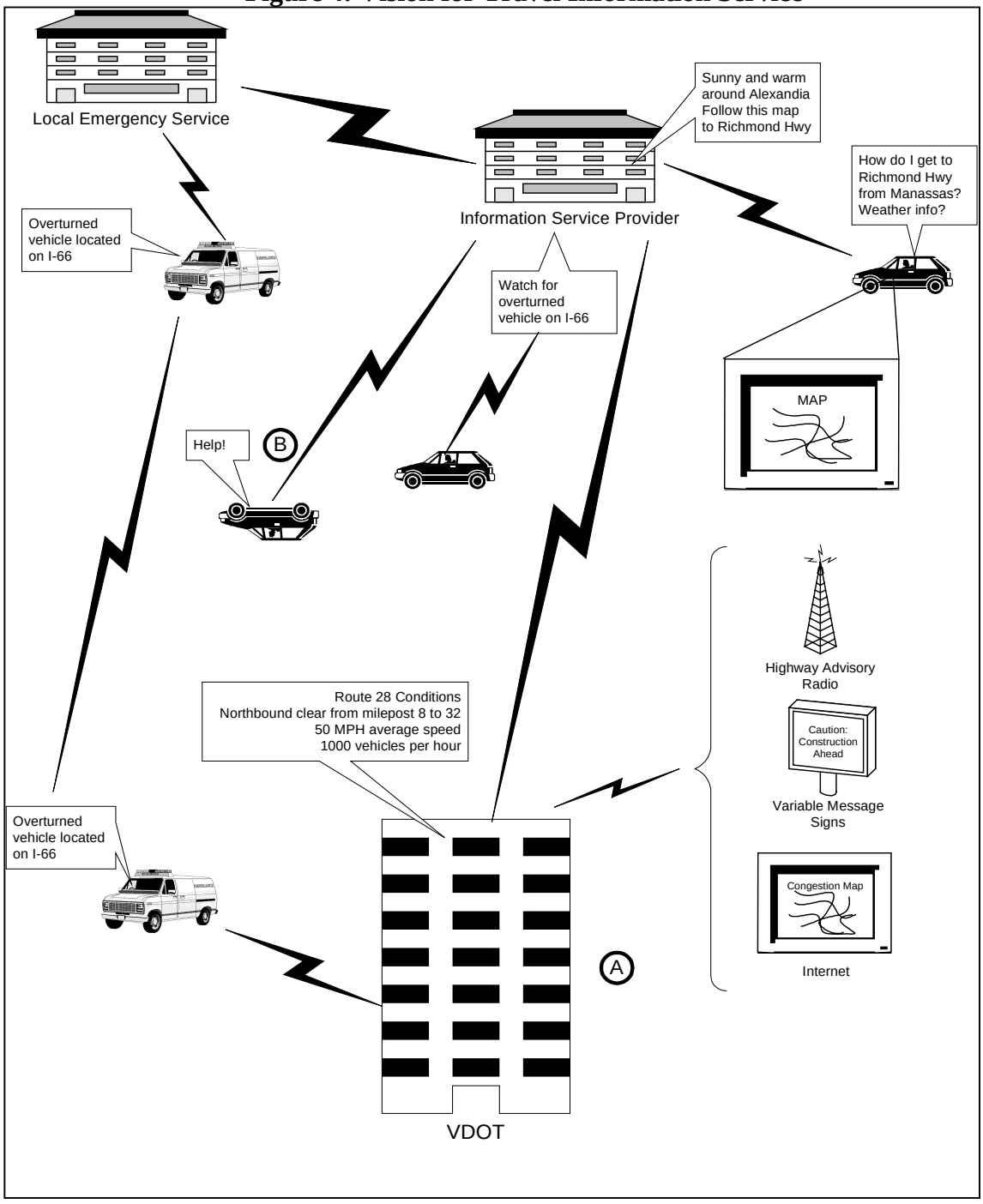


Vision Statements for Travel Information Service

Figure 4, below, graphically represents the following vision statements for Travel Information Service (lettered statements below refer directly to the graphic.)

A. VDOT will provide timely and accurate information on roadway conditions
B. Information Service Providers will support motorists equipped with an automated in-vehicle emergency reporting system

Figure 4: Vision for Travel Information Service



Goals and Objectives

The NOVA Smart Travel goals are a derivative of the overall vision for the district; objectives are simply a further refinement and clarification of the goal statements—perhaps more measurable than the goals themselves. The Smart Travel visioning process yielded the following goals and objectives for the district:

- **Goal: Enhance public safety**
  Objectives:

    1. *Promote safety of transportation facilities:* VDOT will promote safety at public facilities along the roadway network so that travelers feel comfortable and confident about the safety of the facility.

    2. *Reduce crashes on freeways and surface streets:* VDOT will implement safety improvement projects that promote a higher quality of life for the residents and visitors of Virginia.

- **Goal: Operate the transportation system effectively and efficiently**
  Objectives:

    1. *Improve communication and coordination of agency activities:* Maintaining the roadway network operation requires the concerted effort of many offices in VDOT and other agencies. VDOT will share information on, and coordinate with, planned and on-going activities within the agency and with other agencies.

    2. *Improve and maintain flow of traffic on freeways:* Detailed traffic and roadway conditions data is vital for VDOT to assess the performance of the roadway network. This will enable VDOT to be more proactive in managing the roadways for the public.

    3. *Improve and maintain flow of traffic on surface streets:* Traffic flow is managed through the signal system that controls the surface streets. VDOT will ensure that signal control is operating to promote safety and to provide a means for managing traffic to alleviate congestion.

    4. *Increase involvement in identifying new concepts and technologies:* The technological institutions in Virginia (universities, the Transportation Research Council, the Center for Transportation Research, etc.) will be supported by VDOT to create and promote new technologies that benefit all modes of transportation.

    5. *Improve process for outcome-based project planning and implementation:* Measurement of project development will help VDOT gauge the deployment of its programs and track the successful operation of working systems. This information can be used to replicate successes elsewhere in Virginia.

- **Goal: Enhance mobility (using technology)**
  Objectives:

    1. *Reduce travel time and improve schedule reliability for buses and HOV carpool and vanpool users:* VDOT supports the use of multi-occupant vehicles to increase the number of people traveling in each vehicle, and will maximize operations of HOV facilities.

    2. *Reduce demand on the roadway network:* VDOT will work towards promoting other modes of travel and spreading demand so that the use of single occupancy vehicles is reduced and peak congestion is reduced.

    3. *Improve access to the region's major activity centers, recreation areas and places with strategic national interests:* VDOT will ensure that the mobility of the residents and visitors of Virginia is as efficient and provides as much access as reasonably possible.

    4. *Reduce air pollution:* VDOT will work to help improve the quality of life by supporting projects that minimize the emission of harmful airborne pollutants.

- **Goal: Enhance agency operations and maximize the effectiveness and efficiency of personnel, equipment and resources**
  Objectives:

    1. *Improve intra-agency cooperation:* The complex operations of the VDOT NOVA require close coordination among the offices within VDOT. Information sharing is crucial for maintaining the coordinated operation of different work groups.

    2. *Improve inter-agency cooperation:* VDOT is a public organization with a significant influence on the operation of other local and state agencies. VDOT will support the forums through which the Department and other agencies share information.

    3. *Improve efficiency in tracking of resources:* VDOT's enormous inventory must be effectively managed so that resources can be shared when needed, requisitions can be filed based on need, and the maintenance of all VDOT resources can be tracked.

- **Goal: Make the transportation system user-friendly**
  Objectives:

    1. *Improve customer service:* VDOT will ensure that its customers receive the services they request promptly and to their satisfaction.

2. *Simplify payment for transportation services:* VDOT will support a common payment system for transportation services, so that it is easier for customers who use various modes of transportation in their travel.

- **Goal: Support private sector provision of traveler information services**
  Objectives:

  1. *Improve roadway network information dissemination:* Identifying the appropriate media for providing information to travelers will ensure that the right messages get to the right audiences. VDOT will share roadway network condition data with public and private enterprise. In many instances, private enterprise will be more capable of packaging information that the public will desire.

  2. *Support traveler services information by coordinating with other agencies:* VDOT will support dissemination of traveler information, such as parking and tourists activities information through coordination with other agencies. Transit information will be provided to travelers considering alternate modes. Information dissemination will include providing traveler information through VDOT's Highway Advisory Radio.

  3. *Support emergency notification by coordinating with other agencies*: VDOT will support the emergency notification function that provides for the faster notification by travelers involved in an accident. This system will enable emergency services to reach the scene of an incident more quickly with appropriate support equipment, thus reducing response time.

Functions

Functions are descriptions of a specific Smart Travel service that can be part of a Smart Travel deployment project. An example of a function is "detect traffic volumes," which would, for example, help address the goals and objectives relating to system management. VDOT has documented Smart Travel user services based on VDOT's business practices in the *Virginia Smart Travel User Service Definitions Reference.* Functions in each user service are also identified and mapped to National ITS Architecture user service requirements. Thus, the Smart Travel functions demonstrate consistency with the user services of the National ITS Architecture.

Select functions are aggregated to define projects that VDOT can implement as part of the six-year transportation improvement program, or through other funding mechanisms.

Strategic Plan Summary

The Strategic Plan outlines a system engineering process that provides a logical structure to Smart Travel deployment. The system engineering approach is important to intelligent transportation system development, because individual components must communicate and inter-operate to provide maximum functionality. The approach also has the virtue of describing the logical path between goals and functions, which are ultimately fulfilled by the Smart Travel

projects under development district-wide. Finally, the link between "functions" and "user service requirements" demonstrates consistency with the National ITS Architecture.

The Strategic Plan, however, does not relate directly to geography, and does not provide a detailed list of projects. Rather, it provides input to project selection and a guide to track the status of deployment and an evaluation of the projects. There is still a need to develop a list of long-range projects, and criteria for selecting those projects that are most critical to customers in the region.

NOVA SMART TRAVEL LONG RANGE PROGRAM

The VDOT budget process identifies projects that optimize the state's resources, while the Smart Travel Program determines functions through a system engineering process. To conform with the VDOT budget process, Smart Travel projects are identified within a system by gathering collections of functions that are related in purpose, geographic scope, or both. This approach enables VDOT to implement portions of systems as quickly as possible while satisfying the Smart Travel vision and goals and conforming with the National ITS Architecture.

The nature of the Smart Travel projects, as collections of related functions, dictates that some projects be implemented before others. For example, traveler information and incident management systems are wholly dependent on the detection and communication infrastructure put in place for freeway management.

The long-range program recommends projects by comparing the functions revealed by the strategic planning process to the functions accommodated by the current systems in northern Virginia. Identification of the "gap" between current deployment and the functions envisioned by the Strategic Plan provides the long-range project list. Like pieces of a puzzle, the district can identify and implement projects that complete the desired functionality of the system. The following table and graphic describes the long-range program of projects, by system, with a description of their functional purpose.

Smart Travel: Long Range Projects

System	Project	Project Description
Planning, Policy and Internal	Smart Travel Integration and Standards Guidelines	This project will develop guidelines that will help VDOT integrate new Smart Travel projects into their legacy systems. The guidelines will also document the strategies VDOT must take to adopt existing and upcoming standards, such as the National Transportation Communications for ITS Protocol (NTCIP) and Location Referencing System (LRS).
	Congestion Mapping System	This system will develop a traffic occupancy map based on the detector data received from freeways and arterial routes. The Smart Traffic Center and the Smart Signal System will provide the detector data received from freeways and arterial routes, respectively. The system will demonstrate the initiation, dissipation, and level of congestion at any time. This system will support the development of strategies to manage congestion.
	Operations and Management Planning	Once a project is established and implemented VDOT will continue to operate and maintain the project. These activities will require personnel and other resources to sustain the systems. The planning of operations and management for each project will enable VDOT to budget the appropriate personnel and resources. In addition, operations and management planning will rectify historic problems concerning the hiring and retention of skilled staff.
	Decision Support System for Resource Sharing Initiatives	This project will develop guidelines that will help identify the trade-off between resource sharing and other available options in terms of costs and benefits. This project may include the development of a decision support system that automates the comparison process. Additionally, this project will identify new resource sharing opportunities.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Planning, Policy and Internal (continued)	Smart Travel (GIS) Inventory System	This project will develop an inventory system that uses a Geographical Information System (GIS) to document Smart Travel related field equipment and systems. This system will have a graphical user interface to facilitate any update to the inventory.
	Professional Capacity Building	The Professional Capacity Building effort will educate the VDOT personnel on the issues, goals, and technical details of these particular projects. This project will ensure that the Northern Virginia District personnel have the appropriate forums and knowledge to discuss the technical, fiscal, and programmatic issues concerning the Smart Travel implementation. Certain projects of the Smart Travel program will have wide-ranging effects on the operations of the Northern Virginia District.
	Traffic Data Archiving System	This project will automatically archive collected traffic data from freeways and surface streets in a database. This database will be easily accessible for use in any planning, analysis and/or evaluation.
	Smart Travel Program Outreach	This project will disseminate NOVA Smart Travel activities to the regional stakeholders, the general public and other district offices. This project will conduct workshops with regional stakeholders to disseminate on-going and planned Smart Travel activities, to identify the cooperation requirements, and to establish memoranda of understanding among the regional stakeholders.
	Decision Support for Smart Travel Implementations	This project will establish a standard procedure to assess the best possible implementation options that would maximize the benefits of an investment for Smart Travel projects. This procedure will also identify the trade-off between these available options.
	Smart Travel Strategic Planning	This project will periodically update the Smart Travel Framework and the NOVA Smart Travel architecture to reflect the policies, priorities and accomplishments of that period. This project also will disseminate the up-to-date NOVA's Smart Travel Framework
	Coordination with Six-Year Improvement Program	This project will identify and implement Smart Travel projects that can support and complement the projects in the Six-Year Improvement Program.
	Deployment Tracking	This project will evaluate the actual deployment in relation to the Smart Travel Program Plan and update the Program Plan accordingly.
	Smart Travel Spot Safety Project Ranking Criteria	This project will develop criteria to rank spot safety projects. The criteria will provide justification for developing spot safety projects in accord with budget requirements and public service objectives.
	Technical Support to Dulles Toll Road Technology Task Group	The Dulles Corridor Technology Task Group was formed to complete a four-phase project that will lead to the implementation of transit service in the Dulles Corridor. The mission of the Dulles Corridor Technology Task Group is to recommend a policy for application of leading edge technologies to be employed by the Dulles Corridor Task Group in facilitating the planning, design and implementation of express bus, bus rapid transit and rail service in the Dulles corridor. ITS elements under study include parking information delivered via VMS, electronic payment for parking and fares, traveler information on board and at transit stops, and transit vehicle tracking and safety/maintenance monitoring.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Surface Street Management	Regional Signal Coordination	The VDOT-operated signal system will be coordinated with other systems that are not operated by VDOT to obtain optimal traffic flow along a corridor. This system will also have the ability to be coordinated to support diversion strategies during incidents based on an established incident response protocol.
	Signal Priority for Transit/Emergency Vehicles	VDOT will have the capability to provide signal priority to emergency and transit vehicles when appropriate. Decisions to provide signal priority will be based on real-time requests or through prior arrangements. This system should be implemented at intersections that are near emergency medical facilities and along transit routes that are heavily congested.
	Traffic Signal System Field Maintenance	This project will include the maintenance of the signals in the Northern Virginia District. The Project Team will be responsible to maintain the control field hardware and perform routine preventive maintenance on signal equipment, such as replacing bulbs, checking terminal connections, cleaning and replacing of signal head lenses, replacing wire tie-wraps as well as responding to emergencies, such as signal system malfunction.
	Traffic Control Software Maintenance	This project will provide technical support when adding new equipment to the system or to make non-emergency changes including recovering the system from failure of software and hardware and configuring new equipment properly. Additionally, this project will provide emergency services as needed and during the critical Y2K period.
	Traffic Control Software/Hardware Upgrade	This project will modify the traffic control software, so that it can accommodate additional functions. This project will also include the upgrade of the Management Information System for Transportation (MIST) software to run on the Windows NT operating system.
	Real-Time Traffic Adaptive Control System (RT-TRACS) Implementation	This project will implement RT-TRACS at critical locations to improve safety and flow.
	Signal System Evaluation	This project will review and recommend modifications to signal operational elements, such as timing strategies, communications infrastructure, and other hardware and software modules.
	Traffic Control Communication Study	This study will evaluate the communications capacity and infrastructure requirements for meeting the needs of the Northern Virginia District's signal system. Additionally, this project will identify cost-effective communications infrastructure and architecture options to meet the requirements of the signal system.
	Integration of Developer-installed Signals with Smart Travel	Housing and commercial developers install signals in numerous areas, but many of these projects require a level of effort from VDOT for inspections and system integration activities. Anticipated project will integrate Smart Travel with these signal installations, to ensure system integration and support inspection activities.
	Red Light Running Cameras	Cameras will be installed at intersections to identify and record vehicles violating red light signals. The license plate number of the violating vehicle will be recorded to identify the registration. The law enforcement agency will take appropriate action against the violators. This system should be installed at signalized intersections with a high crash rate due to traffic law violation.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Surface Street Management (continued)	Head-on Traffic Warning System and Evaluation	This system is installed where road geometry limits sight distances for drivers, and has specific application at one-lane underpasses. The system has a dynamic sign placed on either side of the underpass that indicates approaching traffic when detected. This system should be built where the road geometry is such that there is limited sight distance for traffic going through the one lane underpass.
	De-icing System Evaluation	This project will install a de-icing system at selected critical highway locations that are susceptible to icing hazards, such as bridge decks. This project will evaluate the effectiveness of this system for reducing the risk of ice-related crashes. This system spreads anti-icing agents when temperature and precipitation thresholds are exceeded, to neutralize patches of ice.
	Automated Pedestrian Safety System	The pedestrian detector provides the means to automatically detect the presence of pedestrians in a targeted curbside area, and replaces or augments the standard push button used to activate the pedestrian call feature. The detectors also automatically detect the presence of pedestrians in a crosswalk area, and accordingly adjusts the clearance interval necessary to provide more time to cross.
	Bicyclist Safety Enhancement	This project will increase the visibility of bicycle paths at selected intersections by pavement marking or speed bumps; in addition, this system will activate a warning message to motorists approaching the intersection if a bicyclist is present.
	Grade Crossing Safety Enhancement	Closed circuit TV technology will monitor railroad grade crossings and adjacent areas for identifying, tracking and documenting specific areas that need maintenance. The system will also detect and verify incidents at the grade crossing. The system is most appropriate for grade crossings that have a high traffic volume and/or a historically high crash rate.
	Spot Safety Project Placeholder	Placeholder for spot safety projects that arise through unforeseen need or unique opportunity.
Freeway Management	Freeway Access Control System	This project will establish a freeway access control or ramp-metering algorithm that will optimize flow to the freeway and from the arterial. This algorithm will be implemented at selected sites to evaluate its effectiveness. Possible sites include ramps that have a high impact on vehicle flow on the freeway mainline.
	Integrated Traffic Management	This system will include the integration of freeway operations and surface street operations, including coordination between VDOT and non-VDOT systems that are operated by local jurisdictions. This system will place closed-circuit television (CCTV) at strategic locations to support traffic diversion by ensuring that the diversion facility will be able to handle the traffic. Furthermore, this project will integrate the freeway control systems (ramp metering) with the surface street control system.
	Integration of Signal, Freeway and Safety Service Patrol (SSP) Operations	This project will enable the integration of surface street and freeway operations, where Signal Operations Center will continuously receive the freeway status information. The Smart Traffic Center will send alert to the Signal Operations Center that traffic are being diverted and being recommended to divert to specific surface streets due to an incident. Based on the information received from the Smart Traffic Center, Signal Operations Center would implement strategies, such as changing the timing plans, to handle the diverted traffic from freeways to these surface streets. Additionally, this project will enable the Smart Traffic Center to be integrated with the Safety Service Patrols operations in identifying, verifying, and clearing incidents from the freeway.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Freeway Management (continued)	Analysis of Traffic Management Needs	This project will identify the anticipated transportation problems in the Northern Virginia region and the potential contributions of traffic management strategies in meeting these needs. This project will identify specific traffic management strategies that are proven to be effective in solving transportation problems.
	Evaluation of Cellular Call Locating System	This project will evaluate the efficacy of locating cellular phone signals on the roadway for determining travel time, vehicle speed, etc. Additionally, this project will evaluate the application of this technology for traffic management and traveler information applications.
	Transponders as Probes	This project will utilize transponders that are placed on vehicles as toll tags. This project will install readers on roadways or areas where congestion in a known problem, or portable units can be constructed for special events and for work zones to determine travel times. This project will aid in determining incidents through an incident detection algorithm. This algorithm determines the probability of an incident when transponder-equipped vehicles detected at an upstream reader site are not detected at the downstream site within the expected arrival time.
	Smart Traffic Center Software and Hardware Maintenance	This project will include the maintenance of the Smart Traffic Center software and hardware. The Project Team will maintain and perform periodic upgrade of central system and field software modules. The hardware maintenance includes upgrading the central mainframe and personal computers, the internal network of the central system, the communication and central hardware.
	Co-locate Smart Traffic Center, Smart Signal Control Center, and SSP Operations Control	This project will co-locate the signal system control center, Smart Traffic Center and SSP operations for integrated, expanded and efficient operations.
	Freeway Management System Evaluation	This project will estimate the benefits of the Freeway Management Systems in reducing travel time and improving safety.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Freeway Management (continued)	Freeway System Completion Projects	The Smart Traffic Center (STC) currently monitors and operates Smart Travel devices on following highways sections: 1. 10-mile stretch of I-66 between the Capital Beltway and the Roosevelt Bridge 2. 11.5-mile segment of the Shirley Highway (I-395) between the Capital Beltway and the 14th Street Bridge 3. 10 miles of the Capital Beltway (I-495/95) in the area of the Woodrow Wilson Bridge. 4. The high-occupancy vehicle (HOV) facilities of I-66, I-95, and I-395. The following projects are included to complete the geographical and functional coverage of STC under the Interstate system completion projects. The functional coverage includes incident detection, traffic surveillance, traffic control (ramp metering), variable message signs, gate control (of reversible lanes) and lane control (indication of travel lane). **Integrate STC sub-systems for I-66 and I-395 inside the Capital Beltway to the new software system** This project will integrate incident detection (loop detectors) system, surveillance and verification system (closed-circuit television), traffic control (ramp metering), traveler advisory (variable message signs), HOV gate control system and the Lane Control System. **STC sub-systems for I-495** Currently, the Smart Traffic Center monitors and manages traffic on 10 miles of the Capital Beltway (I-495/95) in the Woodrow Wilson Bridge area. This project will implement incident detection, verification and support to incident response/clearance on all of I-495 within Virginia. This project will include loop detectors, closed circuit television, and variable message signs on I-495 to support incident detection, verification, clearance, traveler advisory and traffic management. **I-66 from 17-mile away from beltway to I-81** This project will integrate incident detection (loop detectors),sub-system, surveillance and verification system (closed-circuit television), traffic control (ramp metering,), traveler advisory (variable message signs), HOV gate control systems and Lane Control System. **Dulles Toll Road**. This project will implement incident detection, verification and support to incident response/clearance on the Dulles Toll Road. This project will include loop detectors, closed circuit television, and variable message signs on the Dulles Toll Road from I-66 to Route 28/Sully Road.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Freeway Management (continued)	Road and Highway Projects in the Regional Long-Range Plan	It is the policy of VDOT to include Smart Travel infrastructure in all major road construction projects, including widening and new facilities.The regional (constrained) long range transportation plan for Northern Virginia currently lists the following projects; it is uncertain which of these projects will ultimately be programmed for funding. ▪ I-66 HOV (peak) Widen, 4 to 6 HOV lanes, from I-66 from US 15 to VA 234 ▪ I-95 HOV (peak)Two new HOV lanes, from Stafford/Prince William County line to I-395 ▪ I-395 HOV (peak) Widen, 2 to 3 HOV lanes, from I-95 to DC line ▪ I-95 Widen, 6 to 8 lanes, from Newington to VA 123 ▪ VA 7 Upgrade to freeway, from VA 7/US 15 bypass to Dulles Toll Road ▪ VA 7 (Leesburg bypass) Widen, 4 to 6 lanes, from Bus. 7 West to Bus. 7 East. ▪ VA 28 Widen, 2 to 4 lanes, from VA 215 to VA 234 bypass ▪ US 29 Widen, 4 to 6 lanes, from Cedar Lane to I-495 ▪ VA 123 Widen, 4 to 6 lanes, from Fairfax/Prince William Co. line to the Burke Center Parkway ▪ VA 234 Widen, 2 to 4 lanes, from Waterway Drive to VA 234 bypass ▪ VA 234 bypass New facility, VA 28 to VA 234/649 south of Manassas ▪ Dulles Airport Access Road Widen, 4 to 6 lanes, from Dulles Airport to VA 123 ▪ Fairfax Co. Parkway New facility, Sunset Hills Road to VA 7; widen, 4 to 6 lanes, from Sunrise Valley Road to VA 123 ▪ Fairfax Co. Parkway New facility, F-S Parkway to Fullerton Road ▪ Battlefield Parkway New facility, US 15 to US 15 bypass North ▪ VA 607 (Loudoun Pkwy) New facility, Dulles Greenway to VA 7 ▪ VA 611 (Telegraph Road) Widen, 2 to 4 lanes, from US 1 to VA 644 (Franconia Road) ▪ VA 619 (Linton Hall Road) Widen, 2 to 4/6 lanes, from US 29 to Devlin Road ▪ VA 638 (Rolling Road) Widen, 2 to 4 lanes, from VA 644 (Old Keene Mill Road) to US 1 ▪ VA 828 (Wiehle Ave) New facility, Reston Pkwy to Dranesville Road
	Interstate System Completion Project Placeholder	Placeholder for unforeseen need or opportunity that arises in the regional interstate system of highways.
Incident Management	Roadway Maintenance Operations Link to TCC	Although the Virginia Operational Information System (VOIS) disseminates data on large construction and maintenance activities, smaller maintenance projects such as mowing, drainage cleaning, painting and striping, etc. have a localized impact on traffic flow. This system will allow the TCC to receive information on smaller scale projects from VDOT, City of Fairfax, City of Alexandria, City of Manassas, City of Manassas Park, and Arlington County and disseminate the information to the Smart Traffic Center and the Smart Signal System.
	AVL for Safety Service Patrol	This project will implement AVL on all safety service patrol vehicles. This system will locate the real-time position of safety service patrol vehicles, thus helping in resource management and incident location identification.
	Work zone Safety System	This system will have stationary and mobile variable message signs announcing detours, “construction ahead” warnings, and vehicle speed warnings to make the driver aware of their actual approach speed. This system will be utilized as a portable traffic operations center, communicating to the district office and to a virtual transportation operations center (which could be a simple desktop personal computer) at a maintenance facility. This system should be implemented with future construction/maintenance projects that have an effect on local and regional mobility.
	Uniform Incident Response Protocol Implementation	This project will implement the Uniform Incident Response Protocol in incident notification, response, information sharing and support service dispatch protocol within VDOT and with other agencies.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Incident Management (continued)	Low Cost Route Diversion Study	This study will establish a number of predefined alternate routes for heavily traveled roadways through the use of static guide signs and route markers. This system will utilize highway advisory radio and flashing lights to indicate when the alternate route is recommended.
	Mayday System	This system will enable vehicle-based emergency notification received by a private provider to be communicated to VDOT. VDOT will support the establishment of a protocol to assist the emergency management services and other agencies to respond to the incident.
	Uniform Incident Response and Dispatch Protocol Update	This project will periodically evaluate and update the incident identification, response and dispatch protocols.
	Lessons Learned: from Construction Impact Mitigation Strategies	This project will evaluate the impact of the Smart Travel strategies implemented with the on-going and completed construction projects and develop construction mitigation strategies for upcoming construction activities.
	Springfield Interchange Smart Travel Implementation	The objective of this project is to minimize the inconvenience and delays to the traveling public during the improvement of the Springfield Interchange by the application of Smart Travel. This project will include signal systems improvements, traffic demand management and incident management elements. VDOT commenced the construction of the Springfield Interchange Improvement Project in April 1999.
	Woodrow Wilson Bridge Smart Travel Implementation	This project will implement Smart Travel components in the Woodrow Wilson Bridge project limit. Under an existing project, "Woodrow Wilson Bridge ITS Design," the ITS Design Subcommittee for the Woodrow Wilson Bridge (WWB) is developing a seamless corridor-wide ITS design along the Capital Beltway within the WWB project limits. The WWB project section design consultants will complete the ITS design based on the functionality report. This project will implement Smart Travel based on the design that is focused on maintaining existing functionality, to enhance existing functionality during construction, and to identify functionality for the new facility. ITS implementation will include incident detection and management, traveler information including Highway Advisory Radio, and traffic management.
Multi-modal Support	Transportation Demand Management Support	This project will establish communication links with ride sharing and parking providers, so that VDOT can share traffic data and park and ride lots usage data. Additionally, VDOT will receive information from ride sharing and parking management authorities, which VDOT will disseminate through its public website and customer call line.
	Evaluation of Support to Transit Operations	This project will evaluate VDOT's contribution to the overall impact of the Tysons ITS Support project. Based on the evaluation, this project will recommend similar support to other transit related projects.
Customer Service	Customer Service Enhancement	This project will implement a system that automatically tracks customer calls and the actions that were taken to address any customer requests.
	Transportation Communications Center Operations Upgrade	This project will receive, respond and track the actions that were taken to address any customer requests, coordinate all road construction, maintenance and permit work, and coordinate reports and status of roads during emergencies. Additionally, this project will establish a mechanism to forward selected information to the Smart Traffic Center and the Smart Signal System.
	Emergency Call Services Upgrade	This project will establish mechanisms to integrate the emergency 911 calls with the freeway and surface street management systems, so that VDOT can support emergency/incident management activities.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Customer Service (continued)	Customer Satisfaction Survey	This project will survey the district customers on VDOT services, including customer services, such as VDOT's ability to address personal requests.
Comm. System	Inventory of Communications Infrastructure	This project will develop a database of the existing communications infrastructure in the district. Additionally, this project will identify the communications infrastructure and design requirements to meet the future demands of the Smart Travel programs.
	Fiber-Optic Link between I-66 and the Northern Virginia District Headquarters	This project will establish fiber-optic connections between Node 2 of the I-66 fiber optic backbone and the district headquarter. Node 2 is approximately 1,200 feet east of the Route 50 eastbound overpass of I-66.
	Procedures for Maintaining the Communication Infrastructure	This project will establish the procedures and practices to maintain the communication infrastructure. This will involve coordination with the communications companies that install the infrastructure. A schedule for preventive maintenance will be developed to guide VDOT's activities.
	District-wide Communications System Evaluation	This project will evaluate the communications requirements for the Smart Travel programs and recommend strategies to meet the requirements.
Traveler Information System	Parking Information System	This system will provide real-time parking availability and directions to park and ride lots through variable message signs and customer interface outlets. Parking availability information of the park and ride lots will be updated at frequent intervals. If needed, this system should be implemented at park and ride facilities that are operated by VDOT (Only needed if lots approach capacity).
	Enhanced Traveler Information System	This system will feed live traffic video images from the Closed Circuit Television cameras to VDOT's public web site.
	Regional Traveler Information System Re-compete	This project will develop and invite proposals for continuing the Partners in Motion project after the current contract expires.
	Evaluation of the Regional Traveler Information System	This project will evaluate the impact of the Regional Traveler Information System in travel time savings and customer satisfaction.
Asset Management System	Enhanced AVL for Snow Plows	This project will implement AVL on all snow plow vehicles that will allow real-time tracking of their operations. This system will show, in a color-coded map, the location of the snow plow vehicles, which roads have been plowed and which ones are still in need of clearing. This information can also be used for informing the public on the real-time status of snow plow operations.
	Region-wide Coordination with Construction/Road Closures	The project will develop a Geographical Information System based database that will record all existing and planned construction and maintenance activities in the region. This database will be used to identify strategies to mitigate the impacts of these activities on traffic. Additionally, this project will document and coordinate road closures activities. The database will be updated as new information is obtained. This project will also identify the feasibility of integrating this system with the Virginia Operational Information System (VOIS).
	AVL for Fleet Management	This project will equip all VDOT maintenance vehicles with AVL. This will allow VDOT to identify the location of vehicles in real-time, so that these vehicles can be assigned for maintenance operations in an optimal fashion.
	Evaluation of AVL for Fleet Management	This project will evaluate the cost-effectiveness of AVL in managing the maintenance vehicles.

Smart Travel: Long Range Projects		
System	**Project**	**Project Description**
Payment System	Integrated Payment System	This system will identify and implement technical and administrative requirements to implement a payment system that can be used across modes. This system will enable a traveler to pay with the same card for regional buses, trains and tolls.
	Toll Operations Improvements	This project will implement the following improvements: • Install electronic toll collection equipment at the new ramp connecting to the Herndon/Monroe parking lot • Install variable message signs on Dulles Toll road • Install additional toll collection capacity on the ramp from Spring Hill Road to Westbound Dulles Toll road • Update and restore security at the Dulles Toll Road Administration Building • Identify the feasibility of having video enforcement for toll violations • Implement video enforcement for toll violations
	Evaluation of Integrated Payment System	This project will evaluate the benefits of the Integrated Payment System.
Other	Project Placeholder—Unforeseen Opportunities	Placeholder for unforeseen opportunities.

Projects that support these systems can fall into one or more of the following four classifications: "System Management," "System Expansion," "System Upgrade" and "System Evaluation" components. "System Management" refers to the task of operating, maintaining and managing the system's functionality. "System Expansion" refers to projects that increase the geographic coverage of a system. "System Upgrade" refers to the task of adding functionality to a system. The Smart Travel program also includes a periodic "System Evaluation" of each system. This work will help guide future implementation strategies for new system elements.

System expansion and upgrade will take place periodically to manage activities such as the replacement of central or host computer systems; software upgrade of the database management systems or equipment controls systems; and the introduction of new communication systems and services.

The following graphics illustrate that recommended projects complement the existing and planned projects under each of ten Smart Travel systems. Moreover, Appendix III shows the mapping of new, existing and planned projects to functions, objectives, goals, and vision statement.

ACHIEVING THE VISION: SHORT RANGE SMART TRAVEL PROJECTS

To develop the long-range program, functions derived from the strategic planning process were compared to the functions provided by current systems in the district. Identification of the "gaps" between current deployment and the functions envisioned by the Strategic Plan provides the long-range project list.

NOVA developed the short-range program of Smart Travel projects by applying the project selection criteria, described below, to the long-range program of projects. The short-range program of Smart Travel projects is created by applying the criteria for project selection, in concert with funding considerations. Again, projects are developed in a way that they will be inter-operable and contribute the vision, goals and objectives of the Smart Travel program.

Criteria for Project Selection

Selection of projects from the long-range program list is a multi-step process that is largely dependent on funding category. Funding and programmatic features screen candidate projects; some major Smart Travel deployments are being financed as components of larger freeway construction efforts, while other Smart Travel improvements must "compete" with other projects for the VDOT operations budget. The steps of the process are outlined below:

1. Smart Travel Elements of Road Projects Identified in the Regional Transportation Plan

The regional transportation planning process identifies a program of transit and highway projects for its Transportation Investment Program. A number of these projects will include Smart Travel elements as part of the functionality. At the time this Smart Travel plan was developed, the regional 2020 long-range plan was not completed, nor had short-range high priority projects been identified. While the outcome of the regional transportation planning is unknown, the Smart Travel program makes reasonable assumptions about projects to be included, and leaves placeholders for projects that may emerge from the long-range transportation planning process.

2. Maintenance and Operation of Current Systems

Sound fiscal policies dictate that priority be given to the operation and maintenance of existing Smart Travel systems, before embarking on capital outlays for new systems or system expansion. Thus, the second step of project selection was to identify the operating and maintenance needs of current systems and budget for their continued operation.

3. Planning and Evaluation Projects

Since ITS is a new and rapidly developing field, adequate resources are necessary for program planning and evaluation. In comparison to Smart Travel projects themselves, planning and

evaluation projects have a relatively low budgetary impact. The third step of project selection was selecting all planning and evaluation projects.

4. Selection of Safety Projects

Some Smart Travel projects improve the safety of the traveling public, but are not eligible for federal-aid funding from the HEP or HES program; these projects were selected for the Smart Travel program.

5. Projects on a Critical Path that Enables Smart Travel System Development

The importance of a systems approach to Smart Travel development cannot be overemphasized. Many of the benefits of Smart Travel come from data sharing and interoperable management strategies that can only be accomplished through interconnected information systems. This systematic development often depends on key investments that do not have obvious immediate benefit, but are part of a critical path of a regional Smart Travel system. An example might be a telecommunications project that will serve as a backbone for future Smart Travel deployment. The evaluation of potential projects included a critical path analysis that revealed these Smart Travel projects.

6. Placeholders for New Opportunities

There are some Smart Travel projects that may emerge from unique opportunities or needs. For example, private sector vendors often look to VDOT as a partner in beta-testing devices and systems, requiring VDOT participation. Also, a new federal program can provide new revenue for projects. Finally, unforeseen safety issues arise as roads are built or widened or as development increases traffic volumes. Since NOVA cannot anticipate the outcome of these processes, a "placeholder" was created to accommodate projects that may arise.

SHORT RANGE SMART TRAVEL PROJECTS

The following short-range program of projects was developed based on the criteria outlined in the previous section; a complete long-range project list appears at the end of this section, with short-range projects highlighted by **bold** typeface.

For each project in the short-range program, there is provided a detailed project description and concept of operation. The projects also include an estimated cost, if available, with potential funding sources. Potential funding sources are:

- Federal—NHS, STP: Two federal programs provide the majority of federal aid funding. NHS funding is for construction and rehabilitation projects on roads comprising the National Highway System. The Surface Transportation Program (STP) is divided between states and local governments based on population and has wide funding eligibility.
- Federal—CMAQ: The Congestion Mitigation and Air Quality Improvement program was created in 1991. Eligibility criteria generally directs CMAQ funding to urban areas, and projects must show a demonstrable air quality benefit.
- Federal—Planning: A certain percentage of a state's federal-aid apportionment is set aside for state and local transportation planning, including evaluation projects.
- Federal—Safety (HEP/HES): Federal-aid safety program funding is available for projects if they can show a direct reduction in the number of crashes.
- Federal—Earmark: Certain projects receive special congressional consideration through legislative funding earmarks in authorization or apportionment bills.
- State Funding: State funding includes the revenue from the state fuel tax or general revenue funds, administered by VDOT, which are generally dedicated to transportation projects.
- Local Funding: Local funding includes funds raised through sales or property taxes, dedicated to transportation projects.
- Private Financing: Certain projects can attract private partnership for financing. Examples include electronic toll collection and traveler information services.

Smart Travel Integration and Standards Guidelines

This project will develop guidelines that will help VDOT integrate new projects in their legacy systems. The guidelines will also document the strategies VDOT must take to adopt existing and upcoming standards, such as the National Transportation Communications for ITS Protocol (NTCIP) and Location Referencing System (LRS). This project should be integrated with the district Smart Travel Architecture project.

Purpose/Benefits: Integration and standards guidelines will enable VDOT to ensure that its deployed systems feature consistent interfaces, thus promoting interoperability. The consistency of interface design will improve the successful deployment of Smart Travel throughout Virginia.

Project Cost: $150,000

Staff Requirements: to be handled by existing staff. Project management required.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ■ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Congestion Mapping System

This system will develop a traffic occupancy map based on the detector data received from freeways and arterial routes. The Smart Traffic Center and the Smart Signal System will provide the detector data received from freeways and arterial routes, respectively. The system will demonstrate the initiation, dissipation, and level of congestion at any time.

There is also an opportunity to partner with UVA, which has developed a prototype congestion map with signal detectors in NOVA and a congestion map for Hampton Roads.

Purpose/Benefits: This system will support the development of strategies to manage congestion.

Project Cost: $100,000

Staff Requirements: management oversight of professional services contract.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ■ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Operations and Management Planning

Once a project is established and implemented, VDOT will continue to operate and maintain the project. These activities will require personnel and other resources to sustain the systems.

Purpose/Benefits: The planning of operations and management for each project will enable VDOT to budget the appropriate personnel and resources. In addition, operations and management planning will rectify problems of retaining skilled staff.

Project Cost: Not applicable.

Staff Requirements: to be handled by existing staff. Project management required.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Decision Support System for Resource Sharing Initiatives

This project will develop guidelines that will help identify the trade-off between resource sharing and other available options in terms of costs and benefits. This project may include the development of a decision support system that automates the comparison process. Additionally, this project will identify new resource sharing opportunities. The issues of resource sharing decisions will be identified through a stakeholder workshop. Based on the stakeholder input, the guidelines will be developed to identify solutions for all of the issues.

Purpose/Benefits: The decision support system will help VDOT make objective decisions on Smart Travel projects based on the best return on investment. This methodology will help prioritize projects based on their efficacy, thus promoting objective project ranking.

Project Cost: $100,000

Staff Requirements: management oversight of professional services contract.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Smart Travel (GIS) Inventory System

This project will develop an inventory system that uses a Geographical Information System (GIS) to document Smart Travel related field equipment and systems. This system will have a graphical user interface to facilitate any update to the inventory.

Purpose/Benefits: The system will provide VDOT with a readily updated and current inventory of all of its field devices, which will help in the tracking of resources dedicated to maintaining the Smart Travel systems. The inventory will enable VDOT to schedule system maintenance and repair operations by keeping track of each field device.

Project Cost: $210,000

Staff Requirements: Two full-time staff in the first year. Project management required.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Professional Capacity Building

Certain projects of the Smart Travel program will have wide-ranging effects on the operations of the Northern Virginia District. The Professional Capacity Building effort will educate the VDOT personnel on the issues, goals, and technical details of these particular projects.

Purpose/Benefits: This project will ensure that the Northern Virginia District personnel have the appropriate forums and knowledge to discuss the technical, fiscal, and programmatic issues concerning implementation.

Project Cost: not applicable

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Traffic Data Archiving System

This project will automatically archive collected traffic data from freeways and surface streets in a database, making the data easily accessible for use in any planning, analysis and/or evaluation.

The Washington Council of Governments is conducting a feasibility study and implementation plan for utilizing existing and planned ITS, installations and equipment as resources for transportation system usage data. The archiving could be one of the study's outcomes for implementation.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ■ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Purpose/Benefits: ITS systems produce a wealth of data for real-time operation adjustments. If archived, historic data can be used to inform planning decisions on long-term travel trends, the effects of operation adjustments, predictive capability, and other purposes.

Project Cost: $100,000

Staff Requirements: management of professional services contract.

Smart Travel Program Outreach

Outreach activities will provide the public with information on the Smart Travel program and its planning process, and develop dialogue and encourage public input on program focus areas. VDOT will maintain a WebPage to provide information, participate in local transportation planning meetings, and conduct workshops as part of this effort.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Purpose/Benefits: This project will help establish coordination within VDOT Northern Virginia District staff, with other VDOT Districts and with regional stakeholders for the Smart Travel deployment.

Project Cost: $20,000

Staff Requirements: to be handled by existing staff.

Decision Support for Smart Travel Implementation

This project will establish a standard procedure to assess the best possible implementation options that would maximize the benefits of an investment for Smart Travel projects. This procedure will also identify the trade-off between these available options. As a result, VDOT officials will have the ability to make objective decisions on Smart Travel projects based on the best return on investment.

Purpose/Benefits: This methodology will help prioritizing projects based on their respective efficacy; thus will help project selection based on objective ranking. This evaluation will be based on objectives of the decision-makers (such as maximize safety, minimize travel time) and funding constraints.

Project Cost: $ 100,000

Staff Requirements: management of professional services contract.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Smart Travel Strategic Planning

This project updates the previous year's Smart Travel Strategic Plan based on the existing VDOT business practices and policies. The plan provides an internal management tool to develop and track deployment of Smart Travel systems.

Purpose/Benefits: the Smart Travel Strategic Plan aligns NOVA's ITS deployments with the goals and objectives of VDOT, thus enabling effective allocation of human and budgetary resources.

Project Cost: $30,000

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Coordination with Six-Year Improvement Program

This project will identify and implement Smart Travel projects that can support and complement the projects in the Six-Year Improvement Program. The effort will identify roadway widening or construction projects that could impact existing ITS infrastructure, or projects that could benefit from adding ITS components.

Purpose/Benefits: Strategic coordination with the District's other major programs will promote system integration and interoperability.

Project Cost: Not applicable.

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Deployment Tracking

This project evaluates the actual ITS deployment in relation to the Smart Travel plan. The activity involves surveying district staff in charge of Smart Travel systems to identify the status of systems under their purview. In addition to identifying system status, the survey determines the need to add components to upgrade systems or expand their coverage.

Purpose/Benefits: the constant assessment of the state of the Smart Travel Program in relation to VDOT's vision for Smart Travel will keep the programs defined in the Program Plan on an optimal and orderly track.

Project Cost: $50,000

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Operations Funding
- ☐ Local Funding
- ☐ Private Financing

Smart Travel Spot Safety Project Ranking Criteria

This project will develop criteria to rank spot safety projects. The criteria will provide justification for developing spot safety projects in accord with budget requirements and public service objectives.

Purpose/Benefits: the spot safety project ranking criteria will provide savings in time and resources in the project selection process. Additionally, these criteria will select projects based on needs and available budget. This project will also help to establish a systematic project selection process.

Project Cost: $50,000.

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Technical Support to Dulles Toll Road Technology Task Group

The Dulles Corridor Technology Task Group was formed to complete a four-phase project that will lead to the implementation of transit service in the Dulles Corridor. There are many ITS elements under study, including parking information delivered via VMS, electronic payment for parking and fares, traveler information on board and at transit stops, and transit vehicle tracking and vehicle safety/maintenance monitoring.

Purpose/Benefits: VDOT's involvement will ensure interoperability with other VDOT systems, and that this corridor meets the mobility demands of the area's major employers, which contribute to the regional economy.

Project Cost: Not applicable.

Staff Requirements: to be handled by existing staff. Project management required.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Traffic Signal System Field Maintenance

This project involves the maintenance of the Northern Virginia District signals. The Project Team will be responsible to maintain the control field hardware and perform routine preventive maintenance on signal equipment, such as replacing bulbs, checking terminal connections, cleaning and replacing of signal head lenses, replacing wire tie-wraps as well as responding to emergencies, such as signal system malfunction.

Purpose/Benefits: systematic maintenance will reduce the risk of failure and the replacement costs of field hardware.

Project Cost: $1 million annually.

Staff Requirements: 10 full time field inspectors plus staff/project management.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ☐ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Traffic Control Software Maintenance

Software is a major component of the Northern Virginia Smart Signal system. This project will provide technical support when adding new equipment to the system or to make non-emergency changes including recovering the system from failure of software and hardware and configuring new equipment properly.

Purpose/Benefits: this project will minimize the risks of the failure of the signal system, and ensure that the system operates during critical periods.

Project Cost: $ 100,000 annually.

Staff Requirements: to be handled by existing staff. Staff management required.

Project Funding Sources:

- ■ Federal—NHS, STP
- ■ Federal—CMAQ
- ☐ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Traffic Signal System Software/Hardware Upgrade

This project will include the upgrade of the Management Information System for Transportation (MIST) software to run on the Windows NT operating system. Additionally, this project will modify the traffic control software when necessary to accommodate new functions.

Purpose/Benefits: maintain the functionality of the system and accommodate new functions.

Project Cost: $1.5 million

Staff Requirements: management of professional services contract.

Project Funding Sources:

- ■ Federal—NHS, STP
- ■ Federal—CMAQ
- □ Federal—Planning
- □ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Signal System Evaluation

This project will review and recommend modifications to signal operational elements, such as timing strategies, communications infrastructure, and other hardware and software modules.

Purpose/Benefits: the evaluation of signal systems will help measure system performance over time, and the benefit of new functions/upgrades.

Project Cost: part of signal system operation.

Staff Requirements: part of signal system operation.

Project Funding Sources:

- □ Federal—NHS, STP
- □ Federal—CMAQ
- ■ Federal—Planning
- □ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Integration of Developer-Installed Signals with Smart Travel

(Placeholder) Housing and commercial developers may install signals in numerous areas with concurrence of local governments and VDOT, but many of these projects require a level of effort from VDOT for inspections, and system integration activities. Anticipated project will integrate Smart Travel with these signal installations, to ensure system integration and support inspection activities.

Purpose/Benefits: ensure integration of new signals with the regional system.

Project Cost: Not Applicable

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ☐ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ■ Private Financing

Red Light Running Cameras

Cameras will be installed at intersections to identify and record vehicles violating red light signals. The license plate number of the violating vehicle will be recorded to identify the registration. The law enforcement agency will take appropriate action against the violators. This system should be installed at signalized intersections with a high crash rate due to traffic law violation.

Purpose/Benefits: there is evidence from the city of Fairfax, Howard County, MD and San Francisco, CA that the installation of these systems results in an immediate and significant drop in accident rates.

Project Cost: (Assume two locations) $120,000 capital; $12,000 annual operations and maintenance.

Staff Requirements: project management.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ☐ Federal—Planning
- ■ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ■ Local Funding
- ■ Private Financing

Head-On Traffic Warning System and Evaluation

This system is installed where road geometry limits sight distances for drivers, and has specific application at one-lane underpasses. The system has a dynamic sign placed on either side of the underpass that indicates approaching traffic when it is detected. This system should be built where the road geometry is such that there is limited sight distance for traffic going through the one lane underpass.

Purpose/Benefits: the system will reduce the number of incidents and resulting congestion caused by conflicting movements in one-lane underpasses.

Project Cost: (Assume two sites) $600,000 capital; $30,000 annual operations and maintenance.

Staff Requirements: project management; system is self-operating.

Project Funding Sources:

- ■ Federal—NHS, STP
- □ Federal—CMAQ
- □ Federal—Planning
- □ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Grade Crossing Safety Enhancement

Closed circuit TV technology will monitor railroad grade crossings and adjacent areas for identifying, tracking and documenting specific areas that need maintenance. The system will also detect and verify incidents at the grade crossing. The system is most appropriate for grade crossings that have a high traffic volume and/or a historically high crash rate.

Purpose/Benefits: remote monitoring identifies equipment maintenance needs in real time, thus enabling faster repair of malfunctioning equipment, which results in a reduction in crashes at highway-railroad at-grade crossings.

Project Cost: (Assume two sites) $100,000 capital; $10,000 annual operations and maintenance.

Staff Requirements: project management; system is self-operating

Project Funding Sources:

- ■ Federal—NHS, STP
- □ Federal—CMAQ
- □ Federal—Planning
- ■ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Spot Safety Project Placeholder

This project placeholder is included for accommodate opportunities or to meet unique needs that arise for spot safety improvements. Such improvements are critical to safe, efficient transportation, so addressing problems and opportunities quickly is critical to serving the public interest. No specific cost or funding information is provided.

Evaluation of Cellular Call Locating System

This project will evaluate the efficacy of locating cellular phone signals on the roadway for determining travel time, vehicle speed, etc. Additionally, this project will evaluate the application of this technology for traffic management and traveler information applications. Cellular telephone service providers are required to satisfy an FCC mandate by 2001 to locate the position of mobile E911 callers.

Purpose/Benefits: The position identification technologies that are under development to satisfy the mandate may be potentially beneficial to traffic management and traveler information applications.

Project Funding: The various technologies are in the developmental phase; no product prices are yet available.

Staff Requirements: management of professional services contract.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Smart Traffic Center Software/Hardware Maintenance

This project will include the maintenance of the Smart Traffic Center software and hardware. The Project Team will maintain and perform periodic upgrade of central system and field software modules. The hardware maintenance includes upgrading the central mainframe and personal computers, the internal network of the central system, the communication and central hardware.

Purpose/Benefits: The intent is to ensure that the hardware and software systems are maintained and upgraded as necessary to satisfy the functional requirements of the system and guard against system failure.

Project Cost: $1.5 million annually.

Staff Requirements: systems/staff management; two software engineers and four technicians.

Project Funding Sources:

- ■ Federal—NHS, STP
- □ Federal—CMAQ
- □ Federal—Planning
- □ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Freeway Management System Evaluation

This project will estimate the benefits of the Freeway Management Systems in reducing travel time and improving safety.

Purpose/Benefits: the information from this project will be used for cost/benefit quantification of future systems, and will in turn provide elected officials and agency decision-makers with more information for program development.

Project Cost: part of system implementation cost.

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- □ Federal—NHS, STP
- □ Federal—CMAQ
- ■ Federal—Planning
- □ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Freeway System Completion Projects

There is a significant lack of monitoring capability on a large portion of the regional freeway system. This project adds detection to those routes. Detector stations will be placed at half-mile intervals along the freeway. The Smart Traffic Center will continuously monitor the traffic conditions on the freeway. Any identified incidents will be verified with the CCTV. Ramp metering will be installed at selected ramps to regulate traffic flow entering the interstate during peak periods. Variable message signs will be used to provide travelers with information concerning network conditions such as incidents and HOV restrictions.

I-66 Project: detection/surveillance from 17 miles west of the beltway to I-81.

I-495 Project: This project will complete installation of detector stations along I-495 from American Legion Bridge to Woodrow Wilson Bridge.

I-66/I-395 Project: This project will integrate STC sub-systems for I-66 and I-395 inside the Capital Beltway with the new software system.

Dulles Toll Road: This project will install traffic detectors, CCTV, and variable message signs along the Dulles Toll Road from the intersection with I-66, to Route 28/Sully Road exit to monitor traffic in real-time.

Project Funding Sources:

- ■ Federal—NHS, STP
- ■ Federal—CMAQ
- □ Federal—Planning
- □ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Purpose/Benefits: improvements to safety, reductions in travel time and delay, increased throughput, and flow improvements.

Project Cost:
I-66: $15 million capital, $1.5 million annual operations and maintenance.

I-495: $4.8 million capital, $314,000 annual operations and maintenance.

I-66/I-395: $2 million capital, $200,000 annual operations and maintenance.

Dulles Toll Road: $1.5 million capital; $150,000 annual operations and maintenance.

Staff Requirements: The Smart Traffic Center will manage and operate these projects.

Interstate System Completion Project Placeholder

This project placeholder is included for accommodate opportunities or to meet unique needs that arise for Interstate System completion projects. Interstate projects can arise from the regional planning process, and the Smart Travel plan makes placeholders to accommodate such projects. No specific cost or funding information is provided.

Purpose/Benefits: to accommodate ITS needs on the regional freeway system.

Project Cost: not available.

Project Staffing Requirements: not available.

Workzone Safety System

This system will have stationary and mobile variable message signs announcing detours, "construction ahead" warnings, and vehicle speed warnings to make the driver aware of their actual approach speed. This system will be utilized as a portable traffic operations center, communicating to the district office and to a virtual transportation operations center (which could be a simple desktop personal computer) at a maintenance facility. This system should be implemented with future construction/maintenance projects that have an effect on local and regional mobility.

Purpose/Benefits: implementation will increase safety for field personnel and travelers.

Project Cost: Approximately $200,000 per system; $20,000 annual operations and maintenance.

Staff Requirements: one system operator assigned to each workzone.

Project Funding Sources:

- ■ Federal—NHS, STP
- □ Federal—CMAQ
- □ Federal—Planning
- □ Federal—Safety (HEP/HES)
- □ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Springfield Interchange Smart Travel Implementation

VDOT commenced the construction of the Springfield Interchange Improvement Project in April 1999. The project will take about eight years to complete. Congestion management and maintenance of traffic are vital elements of the project that will manage the traffic demand and operations during the construction. This project will include signal systems improvements, traffic demand management and incident management. Signal systems improvements will include spot capacity improvements, traffic signal coordination/optimization, and traffic information dissemination.

Purpose/Benefits: The objective of this project is to minimize the inconvenience and delays to the traveling public during the construction period. Traffic demand management will reduce the volume of traffic through the construction zone by encouraging ride sharing, taking the bus, and riding Virginia Rail Express or Metro Rail. Incident management will enable rapid detection and response.

Project Cost: Capital cost of $800,000, and estimated operations and maintenance cost of $90,000.

Staff Requirements: project management; this project will be managed as part of the Smart Signal System.

Project Funding Sources:

- ■ Federal—NHS, STP
- ■ Federal—CMAQ
- □ Federal—Planning
- □ Federal—Safety (HEP/HES)
- ■ Federal—Earmark
- □ State Funding
- □ Local Funding
- □ Private Financing

Woodrow Wilson Bridge Smart Travel Implementation

This project will implement Smart Travel components in the Woodrow Wilson Bridge project limit. Under an existing project, "Woodrow Wilson Bridge ITS Design," the ITS Design Subcommittee for the Woodrow Wilson Bridge (WWB) is developing a seamless corridor-wide ITS design along the Capital Beltway within the WWB project limits. An ITS functionality report has been completed, which will allow design consultants to complete the ITS design. This project will implement ITS based on the design that is focused on maintaining existing functionality, to enhance existing functionality during construction, and to identify functionality for the new facility.

The project will include incident detection, incident management and traveler information functions including Highway Advisory Radio. Inductive loops will be installed on the roadway surface at half-mile intervals to detect the presence of stationary or slow moving traffic. When these conditions are detected, an advisory 50-mph speed sign is set upstream to warn approaching vehicles of traffic problems ahead. At the same time, the local police department is alerted of the location of the incident.

Purpose/Benefits: incident detection will improve the safety of motorists with warnings of incidents, thus reducing the likelihood of secondary crashes. Timely clearance of traffic incidents will reduce traffic congestion.

Project Cost: $10 million; $1 million annual operation and maintenance.

Staff Requirements: project/systems management; one transportation systems engineer, and one technician.

Project Funding Sources:

- ■ Federal—NHS, STP
- □ Federal—CMAQ
- □ Federal—Planning
- □ Federal—Safety (HEP/HES)
- ■ Federal—Earmark
- ■ State Funding
- □ Local Funding
- □ Private Financing

Evaluation of Support to Transit Operations

This project will evaluate VDOT's contribution to the overall impact of the Tysons ITS Support project. Based on the evaluation, this project will recommend similar support to other transit related projects.

Purpose/Benefits: information will improve the decision making for transit assistance, based on quantifiable, objective criteria.

Project Cost: not applicable.

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ■ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Customer Satisfaction Survey

This project will survey the District customers on VDOT services, including customer services, such as VDOT's ability to address citizen requests.

Purpose/Benefits: provides a management tool to benchmark customer service performance.

Project Cost: Not applicable.

Staff Requirements: project management; to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Inventory of Communications Infrastructure

This project will identify and record the current and future communications infrastructure of the NOVA district.

Purpose/Benefits: Accurate inventory of communications assets.

Project Cost: $1 million.

Staff Requirements: management of professional services contract.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Procedures for Maintaining the Communications Infrastructure

This project will establish the procedures and practices to maintain the communication infrastructure. This will involve coordination with the communications companies that install the infrastructure. A schedule for preventive maintenance will be developed to guide VDOT's activities. The project team will identify the types of communications infrastructure that supports the Smart Travel Program, and survey other industry's accepted practices and standards for maintaining communications infrastructure.

Purpose/Benefits: Smart Travel depends on the communication between various components within a system and between different systems. Communications infrastructure, either wireline or wireless, are vital to the operations of Smart Travel. A standard and documented maintenance procedure is a major step toward the efficient operation of the communication infrastructure.

Project Cost: $100,000.

Staff Requirements: one project engineer; project management.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

District-wide Communications System Evaluation

This project will evaluate the communications requirements for the Smart Travel programs and recommend strategies to meet the requirements.

Purpose/Benefits: Evaluation of the communications system will reveal any deficiencies that could be enhanced by cost-effective upgrades.

Project Cost: part of communications inventory project.

Staff Requirements: management of professional services contract.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Evaluation of Regional Traveler Information System

This project will evaluate the impact of the Regional Traveler Information System in travel time savings and customer satisfaction.

Purpose/Benefits: Evaluation will establish benchmarks, allowing management to assess the benefits of the system and performance over time.

Project Cost: part of Traveler Information System cost.

Staff Requirements: to be handled by existing staff.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Operations Funding
- ☐ Local Funding
- ☐ Private Financing

Integrated Payment System

This system will identify and implement technical and administrative requirements to implement a payment system that can be used across modes. This system will enable a traveler to pay with the same card for regional buses, trains and tolls. The transportation consumers throughout the region will benefit from a unified means of payment. This project will include the development of technical and institutional requirements for implementing an integrated payment system across all modes, thus requiring the collaboration of all revenue-supported transportation providers throughout the region.

Purpose/Benefits: simplified payment for travelers throughout the region; more efficient collection and administration of payment systems; enhanced use of some travel services such as transit.

Project Cost: $250,000.

Staff Requirements: management of professional services contract.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ■ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Evaluation of Integrated Payment System

This project will evaluate the benefits of the Integrated Payment System.

Purpose/Benefits: Quantify the cost and benefits of an integrated payment system to evaluate the merits and guide future policy.

Project Cost: Included in implementation

Staff Requirements: project management.

Project Funding Sources:

- ☐ Federal—NHS, STP
- ☐ Federal—CMAQ
- ■ Federal—Planning
- ☐ Federal—Safety (HEP/HES)
- ☐ Federal—Earmark
- ■ State Funding
- ☐ Local Funding
- ☐ Private Financing

Project Placeholder – Unforeseen Opportunities

A project "placeholder" is created to accommodate new opportunities or unforeseen needs that may arise for the Smart Travel Program. No specific cost or funding information is provided.

SMART TRAVEL PROGRAM SUMMARY

The table on the following page lists the entire program of projects, with the short-range projects in **bold** typeface. Primary system contributions are denoted by a solid symbol (●), and secondary system contributions are denoted by a hollow symbol (○). Projects are further classified as System Management, System Expansion, System Upgrade, and/or System Evaluation.

Projects that support these systems can fall into one or more of the following four classifications: "System Management," "System Expansion," "System Upgrade" and "System Evaluation" components. "System Management" refers to the task of operating, maintaining and managing the system's functionality. "System Expansion" refers to projects that increase the geographic coverage of a system. "System Upgrade" refers to the task of adding functionality to a system. The Smart Travel program also includes a periodic "System Evaluation" of each system. This work will help guide future implementation strategies for new system elements.

System expansion and upgrade will take place periodically to manage activities such as the replacement of central or host computer systems; software upgrade of the database management systems or equipment controls systems; and the introduction of new communication systems and services.

SMART TRAVEL PROGRAM PLAN LONG RANGE AND SHORT-RANGE PROJECTS														
	Smart Travel System										Project Type			
Projects	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Smart Travel Integration and Standards Guidelines	●	○	○	○	○	○	○	○	○	○	●	○		
Congestion Mapping System	●	○	○	○							○		●	
Operations and Management Planning	●	○	○	○	○	○	○	○	○	○	●			○
Decision Support System for Resource Sharing Initiatives	●						○				●			○
Smart Travel (GIS) Inventory System	●										○		●	
Professional Capacity Building	●	○	○	○	○	○	○	○	○	○	●			○
Traffic Data Archiving System	●	○	○								○		●	
Smart Travel Program Outreach	●										●	○		
Decision Support for Smart Travel Implementations	●											●	○	
Smart Travel Strategic Planning	●										●		○	
Coordination with Six-Year Improvement Program	●										○	●		
Deployment Tracking	●										○			●
Smart Travel Spot Safety Project Ranking Criteria	●	○	○	○	○	○	○	○	○	○	●			○
Technical Support to Dulles Toll Road Technology Task Group	●		○		○						●		○	
Regional Signal Coordination		●									●	○		
Signal Priority for Transit/Emergency Vehicles		●			○						○		●	
Traffic Signal System Field Maintenance		●									●			○

Bold type indicates that the project is recommended for inclusion in the Short-Range Plan.

● - Indicates a principal function for the project.
○ - Indicates a supportive function for the project.

SMART TRAVEL PROGRAM PLAN LONG RANGE AND SHORT-RANGE PROJECTS														
	Smart Travel System										Project Type			
Projects	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Traffic Control Software Maintenance		●									●		○	
Traffic Control Software/ Hardware Upgrade		●									○		●	
Real-Time Traffic Adaptive Control System (RT-TRACS) Implementation		●										●		○
Signal System Evaluation	○	●											○	●
Traffic Control Communication Study	○	●					○					○		●
Integration of Developer-installed Signals with Smart Travel		●									○	●		
Red Light Running Cameras		●									○	●		
Head-on Traffic Warning System and Evaluation	●	●									○	●		○
De-icing System Evaluation		●									○	●		○
Automated Pedestrian Safety System		●									○	●		
Bicyclist Safety Enhancement		●									○	●		
Grade Crossing Safety Enhancement		●									○	●		
Spot Safety Project Placeholder		●									○	●		
Freeway Access Control System		○	●								●		○	
Integrated Traffic Management		○	●								●		○	
Integration of Signal, Freeway and Safety Service Patrol (SSP) Operations		○	●	○								○	●	
Analysis of Traffic Management Needs	○		●								●			○
Evaluation of Cellular Call Locating System	○		●	○			○	○			○			●
Transponders as Probes			●	○			○	○		○		○	●	
Smart Traffic Center Software and Hardware Maintenance			●								●			○

Bold type indicates that the project is recommended for inclusion in the Short-Range Plan.

● - Indicates a principal function for the project.
○ - Indicates a supportive function for the project.

SMART TRAVEL PROGRAM PLAN LONG RANGE AND SHORT-RANGE PROJECTS														
	Smart Travel System										Project Type			
Projects	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Co-locate Smart Traffic Center, Smart Signal Control Center, and SSP Operations Control		○	●	○							●		○	
Freeway Management System Evaluation	○		●										○	●
Freeway System Completion Projects			●	○			○	○			○	●		
Road and Highway Projects in the Regional Long-Range Plan			●	○			○	○			○	●		
Interstate System Completion Project Placeholder			●	○			○	○			○	●		
Roadway Maintenance Operations Link to TCC		○		●					○		●		○	
AVL for Safety Service Patrol			○	●								○	●	
Workzone Safety System				●							●			○
Uniform Incident Response Protocol Implementation				●							●			○
Low Cost Route Diversion Study	○	○		●							●			○
Mayday System				●							●			○
Uniform Incident Response and Dispatch Protocol Update				●									●	○
Lessons Learned From Construction Impact Mitigation Strategies	○			●							○			●
Springfield Interchange Smart Travel Implementation				●		○		○				●	○	
Woodrow Wilson Bridge Smart Travel Implementation				●		○		○				●	○	
Transportation Demand Management Support	○				●						○		●	
Evaluation of Support to Transit Operations	○				●							○		●
Customer Service Enhancement						●					○		●	

Bold type indicates that the project is recommended for inclusion in the Short-Range Plan.

● - Indicates a principal function for the project.
○ - Indicates a supportive function for the project.

SMART TRAVEL PROGRAM PLAN LONG RANGE AND SHORT-RANGE PROJECTS														
	Smart Travel System										Project Type			
Projects	Planning/Policy	Surface Street Mgt.	Freeway Mgt.	Incident Mgt.	Multi-modal	Customer Service	Communications	Traveler Info.	Asset Mgt.	Payment	System Mgt.	System Expansion	System Upgrade	System Evaluation
Transportation Communications Center Operations Upgrade		○	○	○		●					●		○	
Emergency Call Services Upgrade						●							●	○
Customer Satisfaction Survey	○					●					○			●
Inventory of Communications Infrastructure	○						●						○	●
Fiber-Optic Link between I-66 and the Northern Virginia District Headquarters							●					●	○	
Procedures for Maintaining the Communication Infrastructure	○						●				●			○
Districtwide Communications System Evaluation	○						●					○		●
Parking Information System					○			●					●	○
Enhanced Traveler Information System					○			●					●	○
Regional Traveler Information System Recompete					○			●			●	○		
Evaluation of the Regional Traveler Information System	○							●			○			●
Enhanced AVL for Snow Plows									●		○		●	
Regionwide Coordination with Construction/Road Closures	○								●		●	○		
AVL for Fleet Management									●			●		○
Evaluation of AVL for Fleet Management	○								●		○			●
Integrated Payment System					○					●		○	●	
Toll Operations Improvements			○							●		○	●	
Evaluation of Integrated Payment System	○									●			○	●
Project Placeholder—Unforeseen Opportunities														

Bold type indicates that the project is recommended for inclusion in the Short-Range Plan.

● - Indicates a principal function for the project.
○ - Indicates a supportive function for the project.

PROGRAM COST SUMMARY

Smart Travel System	Capital or Implementation Cost*	Annual Operation/Maintenance or Personal Services Cost**
Planning and Policy	$ 910,000	$ 0
Surface Street Management	$ 2,320,000	$ 1,152,000
Freeway Management	$ 23,300,000	$ 3,664,000
Incident Management	$ 11,000,000	$ 1,110,000
Multi-modal		
Customer Service		
Communications	$ 1,100,000	
Traveler Information		
Asset Management		
Payment	$ 250,000	
Total:	**$ 38,880,000**	**$ 5,926,000**

* *Capital or Implementation Cost* includes the one-time cost of implementing or executing a project.
** *Annual Operation/Maintenance or Personal Services Cost* is the yearly cost to maintain and operate the system, including hardware, software and personal services expenses. Where exact data was unavailable, it was assumed that these annual expenses would be 10% of the system's implementation cost.