



VIRGINIA

VIRGINIA DEPARTMENT OF TRANSPORTATION
SMART TRAVEL STRATEGIC PLAN — 2001

Smart Travel



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PREFACE

Late November in Virginia...

A powerful storm off the coast is bringing high winds with the threat of snow to Northern Virginia, and heavy rains in Central and Southside Virginia. Two friends are planning to meet each other for dinner at a new restaurant in Arlington at 6:30 p.m. The threat of bad weather looks to make this an unusually heavy rush hour.

Bob works downtown at a law firm on K Street. He is looking forward to dinner with his old college friend, Sue, who he hasn't seen in several months. Sue works at a medical technology company in suburban Loudoun County. She has wanted to try this new restaurant for weeks and Bob's recent phone call provided the perfect opportunity.

5:30 p.m.:

Heavy snow has begun to fall. Bob notices that he has a message coming in on his pager. He checks the message. "Three car accident on Roosevelt Bridge westbound. Seek alternate route." Within seconds Bob's pager goes off again. "Single vehicle accident on Key Bridge westbound. Seek alternate route."

Bob subscribes to a service that provides him up-to-the-minute traffic alerts on his pre-selected commuting routes. With two primary routes out of the city backed-up, Bob makes the decision to take the subway over the river to meet Sue for dinner. A quick jump to the Internet gives Bob all the information he needs on the nearest train station and the status of the trains. Passenger volumes are heavy but the trains are running on time. Bob decides to leave his car in the garage and take the subway instead.

Meanwhile, Sue is taking care of some last minute e-mails when a co-worker stops in to tell her that it has begun to snow. Sue peers out the window and thinks that she better get moving if she wants to be on time to meet Bob for dinner. Before gathering her things to leave, Sue goes onto the Internet to check road conditions. Sue is able to look at live camera images provided by VDOT to see how traffic is moving on the various routes she might take to get to Arlington. Traffic seems to be moving fine on the Dulles Toll Road so she decides to take it to I-66 into Arlington.

5:45 p.m.:

Sue is able to by-pass long lines at the toll plaza because she has an electronic toll tag on her car that allows her to pay the toll without stopping. Ten minutes into her trip, Sue's car phone rings. It is Sue's traveler information service calling her with an automated message advising Sue that there is an accident on I-66 eastbound. All lanes are blocked. Fortunately for her, Sue's car is equipped with an interactive voice navigation system.

Using voice commands, Sue is able to ask for alternate directions from the on-board navigation system. The computer checks for routes with the least traffic congestion and tells Sue she can get to the restaurant in Arlington by taking I-495 north to the George Washington Parkway east. Sue accepts this recommendation and exits the toll road at I-495. "I might still make it on time," she muses.

6:00 p.m.:

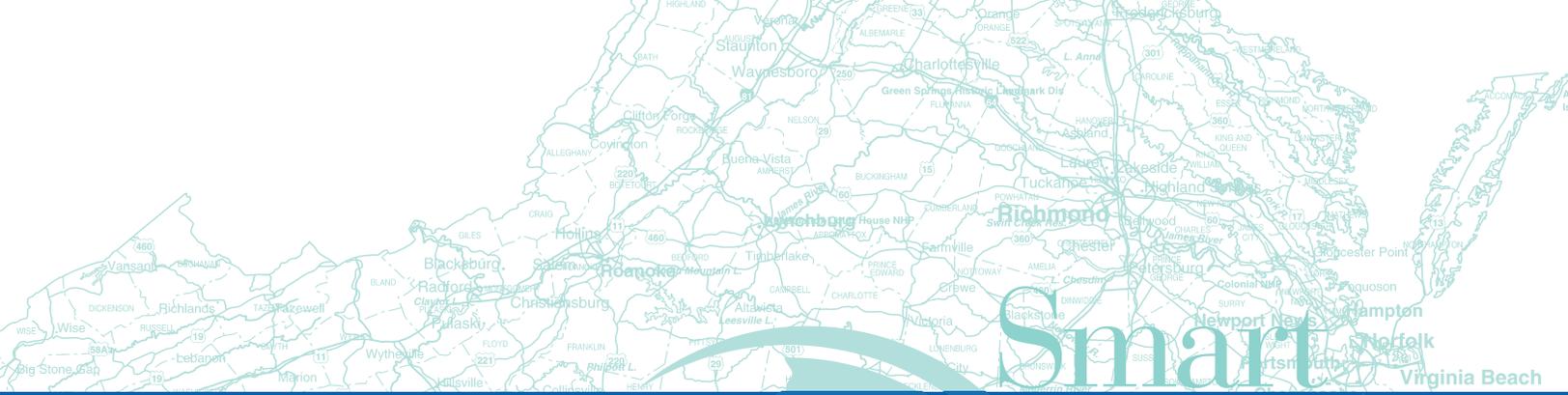
Back downtown, Bob is enjoying the walk through the snow to the subway station. He enters the subway station and is able to get on the first train headed west toward Arlington. Finding a seat, he is able to start reading the book that he has been carrying around in his briefcase for weeks. "This is much better than sitting in traffic. It looks like I'll even be on time to meet Sue for dinner," Bob says to himself.

6:10 p.m.:

Road conditions are deteriorating rapidly. As Sue negotiates a curve on the Parkway, Sue's car suddenly slides off the road and down a slight embankment, coming to a gentle stop two feet from a large oak tree. Sue breathes a sigh of relief that she is not hurt and her car is undamaged. Sue's car phone rings. It is her vehicle security service calling to see if Sue needs assistance. Her car automatically sent out an alert to her vehicle security service when the car slid down the embankment and came to a sudden stop. Sue tells the operator that she is unhurt but will likely need a tow truck to get back on the road. The service immediately contacts a towing service that is only five miles from Sue's location.

6:40 p.m.:

Sue thanks the tow truck driver for getting there so fast and helping her get back on the road. "I'll be a little late, but what a story I have to tell Bob now!" Sue says to herself.



Smart Travel

INTRODUCTION

“Smart Travel is designed to improve the safety and efficiency of the transportation system in Virginia.”



Purpose

This Intelligent Transportation Systems (ITS) Strategic Plan is the culmination of more than four years of planning and policy development. Building upon the first ITS Tactical Plan in 1996, through two versions of an ITS Business Plan in 1997 and 1998, this plan establishes the statewide vision and direction for ITS in Virginia. The Strategic Plan is a dynamic document that will be updated periodically. In each update, the plan will cover a ten-year horizon.

This Strategic Plan provides planning-level information for the purpose of informing the public and transportation constituencies about the proposed transportation technology program in Virginia, which is known as the Smart Travel program. Smart Travel encompasses technologies and technology-based services designed to improve the safety and efficiency of the transportation system.

In addition to a description of the types of systems and services the Virginia Department of Transportation (VDOT) plans to implement, the plan identifies the roles of VDOT and the private sector in deployment. The VDOT role is further described in terms of the responsibilities of the different organizational and planning boundaries - statewide, regional, corridor and District – as they relate to the planning, operation, and maintenance of the various systems and services.

This Strategic Plan provides an overview of the Smart Travel program and its goals, and provides the reader with an overall vision for how technology can improve transportation in Virginia. Finally, it details the specific activities underway in various key areas including telecommunication, software development, operations, incident and emergency management, and research.

As a supplement to this ITS Strategic Plan, VDOT is preparing an ITS Implementation Plan. The Implementation Plan will provide more detail on where and when technology systems will be deployed statewide. It will form the basis of an integration strategy to ensure that all Smart Travel systems and services work together to form a unified, statewide network. In addition, the ITS Implementation Plan will identify the costs and resources required to achieve the Smart Travel program goals. This information will then form the basis of annual project funding requests for the Department's six-year Transportation Development Plan.

Guiding Principles

The Smart Travel program supports the Department-wide mission of providing safe and efficient transportation services to the public. To further define the focus of the Smart Travel program, the following Guiding Principles were developed. These Guiding Principles have been used to guide the selection of program activities for the past several years. As a result of their success thus far, VDOT will continue to use these principles to guide future phases of program development:

Focus on Practical Transportation Solutions

VDOT will apply practical solutions that result in tangible benefits to the traveling public and to those that operate the systems, all with the desired purpose of improving transportation safety and mobility in Virginia.

Enhance Delivery of Public Agency Services

ITS applications will not only focus on roadway operations, but also on internal operations to enhance customer service by enabling VDOT systems to be more efficient and more effective.

Think Regionally and Act Locally

All ITS strategies will be deployed incrementally by a variety of public and private entities. To meet the needs of travelers on a regional basis, these individual ITS strategies will be knit

together into a cohesive whole on corridor, regional and statewide levels.

Coordinate Intermodal Strategies

Smart Travel will include technologies that enhance modal connections to increase productivity among freight haulers, surface transportation providers, ports, and airports to support the efficient movement of both people and goods.

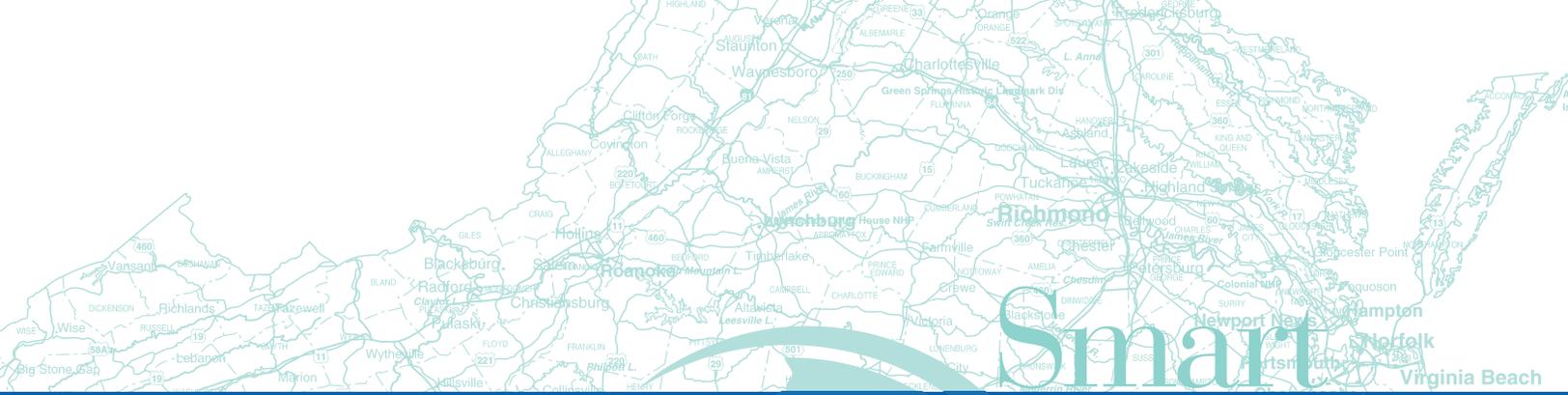
Promote Private Investment

Appropriate private investment in ITS services will allow State agencies to maximize use of their limited resources and improve the quality of all services.

Support ITS Research

Research will be encouraged that helps VDOT keep up with the rapid evolution of technology, to develop Virginia-specific technologies, and to ensure that existing technologies are maximized to meet Virginia's needs.





Smart
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FRAMEWORK FOR ITS IN VIRGINIA

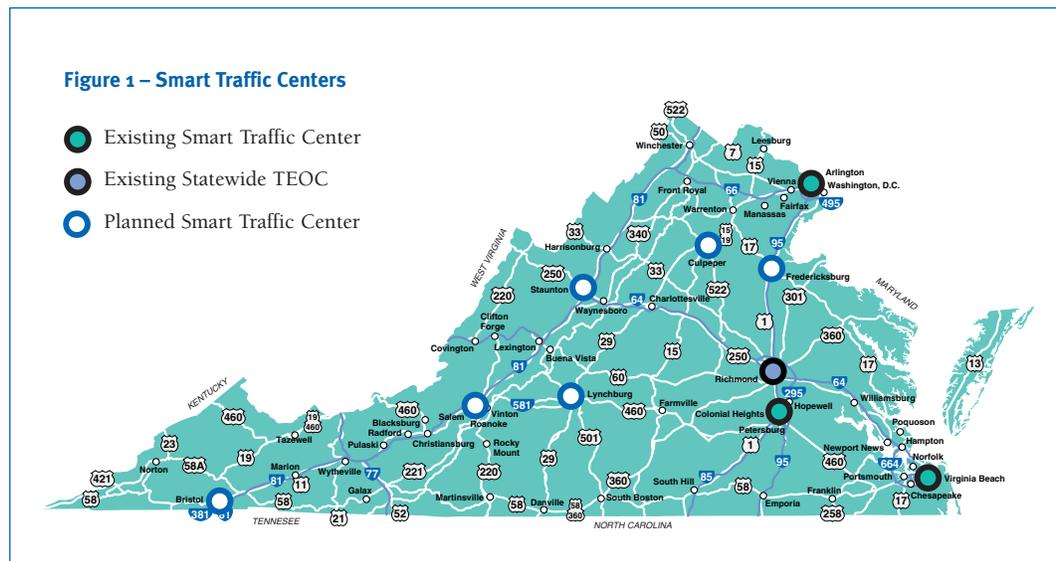
“VDOT will use ITS to improve the delivery of transportation services statewide.”

A framework describes how all elements of a program or system are connected together to accomplish a particular goal. The VDOT ITS Framework is composed of a technical as well as an institutional element. The technical portion of the ITS Framework describes how various technologies and systems are connected electronically. From the institutional perspective, the Framework describes how State practitioners will use the systems to improve the delivery of transportation services. The Framework will connect each of the nine VDOT Districts and the statewide Transportation Emergency Operations Center (TEOC) to create the statewide ITS network.

VDOT's Statewide ITS Framework

Connecting systems and data together in an integrated fashion is critical to the success of the statewide Smart Travel program. People are unaware that they are traveling between VDOT Districts, across city limits or other jurisdictional boundaries, and an integrated network of technology systems allows the delivery of advanced transportation services that likewise are independent of such boundaries. VDOT's ITS Framework is rooted in the concept of integration.

The integrated ITS Framework leverages the capabilities and services of three existing Smart Traffic Centers (STCs) located in Northern Virginia (NOVA), Richmond, and Hampton Roads; six proposed STCs; and the existing TEOC in Richmond, as illustrated in *Figure 1*, below.



Function of the Smart Traffic Centers

The Smart Traffic Centers focus on:

- local traffic and transportation operations and management in their respective Districts; including coordination of local transportation operations with local cities, counties, and transit providers within their District,
- regional traffic and incident coordination within their coverage areas, which may not be the same as the District boundaries, and
- coordination with adjacent STCs and/or TEOC for regional or statewide transportation operations and incident management.

The STCs also support District operations. STCs will support a variety of District operations functions based on each District's needs including providing traffic operations evaluations, monitoring and maintaining road weather sensors that support snow and ice operations, and supporting the provision of information to the public.

Function of the Transportation Emergency Operations Center

The TEOC, as outlined in the legislation that commissioned it, focuses on:

- coordinating the transportation response to statewide emergencies; and
- informing media of the status of any statewide emergencies.

The role of the TEOC as part of the statewide ITS network will continue to evolve over the next several years.

Each STC and the TEOC can be thought of as hubs in the integrated statewide ITS network. They will be connected to one another, as well as to residences, local agencies and others, creating the statewide ITS network.

Statewide Functions – Ensuring The Pieces Fit Together

The development of the statewide ITS Framework involves a broad cross-section of VDOT – Maintenance, Traffic Engineering, Information Technology, Location and Design, Districts and others. However, this framework will be beneficial not only to VDOT, but also will produce benefits to other public agencies, the citizens of Virginia, our private sector partners and those visiting or just traveling through the Commonwealth.

To ensure that this bottom-up planning process results in an integrated whole, certain functions will be coordinated on a statewide basis through the Central Office ITS Division. Examples of existing coordination underway today include:

- providing guidance for the development of District ITS plans
- coordinating VDOT’s approach to implementing a statewide traveler information telephone number (511)
- management of the statewide fiber optic resource sharing project, where the private sector is providing fiber optic communications resources to VDOT in exchange for access to VDOT right-of-way.

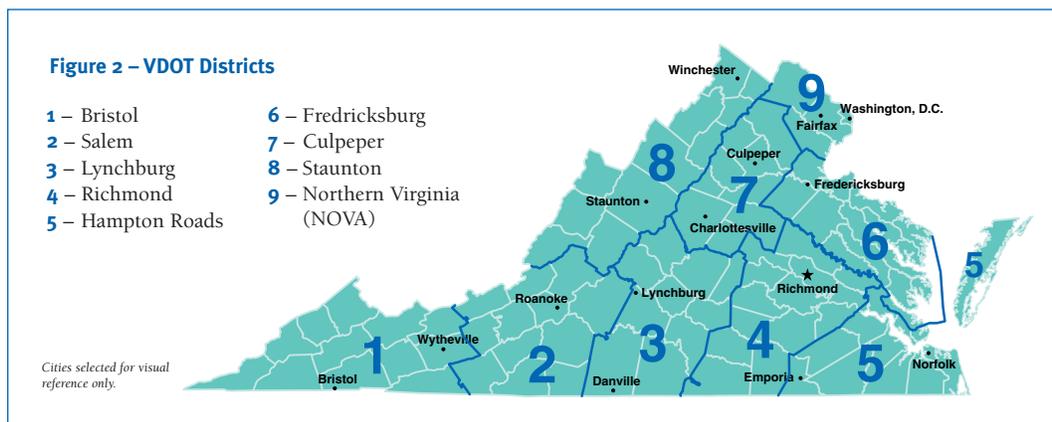
In the future, additional statewide functions will be developed based on District input, as will the roles of statewide entities such as the TEOC. These and other efforts of statewide importance, such as data collection for statewide reporting, statewide Internet-based traveler information, or statewide emergency operations, will also be coordinated through the Central Office ITS Division.

Guiding the statewide program is the Intelligent Transportation Systems Coordinating Committee (ITSCC) made up of District ITS Program Managers (or

a representative appointed by the District Administrator), the Assistant Director of ITS Programs, and representatives from the Information Technology, Maintenance, Planning and Traffic Engineering Divisions. The ITSCC provides strategic direction, leadership and coordination for the Smart Travel program. This includes overseeing the development and implementation of consistent guidelines for statewide project development, resource allocation and progress evaluation. The ITSCC focuses on statewide and multi-District functions and priorities while facilitating consistent program implementation by the Districts and other operating units.

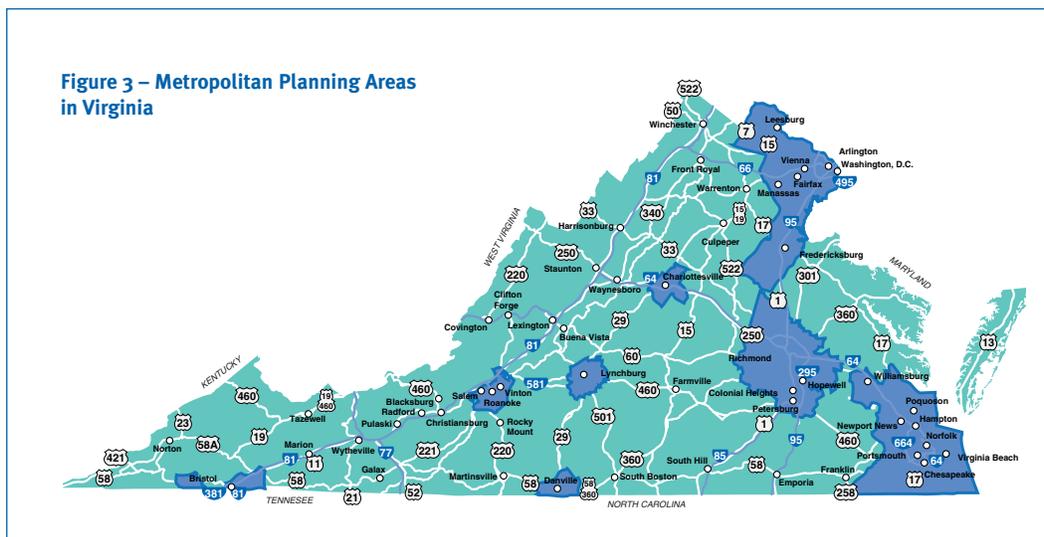
District, Corridor, Regional, Statewide, and Multi-State Operations

The VDOT ITS Framework was developed to ensure statewide integration. However, there are several levels of operations that must also be coordinated. The seamless operation of key corridors, such as I-81 and I-95, requires that Districts coordinate together. Districts located in Metropolitan Planning areas must coordinate on a



regional level with local and regional agencies. *Figure 2* indicates the District boundaries, and *Figure 3* the Metropolitan Planning Area boundaries in Virginia. Comparing the two figures, it is apparent that multi-District coordination will be

required to ensure VDOT provides input to MPOs. And, Virginia borders five states and the District of Columbia. Coordinating operations across state lines is also part of the VDOT ITS Framework.



The following matrix illustrates that each District must coordinate beyond its own boundaries to ensure travelers enjoy the

same service quality across the state. The ITS Division will facilitate planning beyond the District lines.

DISTRICT	Multi-State	Metropolitan Region	KEY CORRIDORS											
			I-81	SR 29	I-95	SR 43	I-66	I-64	SR 58	SR 460	SR 47	SR 15	I-77	
Bristol	✓	✓	✓							✓	✓			✓
Salem	✓	✓	✓							✓	✓			✓
Lynchburg	✓	✓		✓						✓	✓		✓	
Richmond	✓	✓			✓				✓	✓	✓			
Hampton Roads	✓	✓			✓	✓			✓	✓	✓	✓		
Fredericksburg		✓			✓							✓		
Culpeper				✓					✓			✓	✓	
Staunton	✓		✓					✓	✓			✓		
NOVA	✓	✓		✓	✓			✓					✓	

VDOT ITS User Services

ITS in Virginia is focused on the development and implementation of a collection of specific inter-related services that can be offered to various customer groups or “users.” The USDOT, as a service to state and local agencies, developed more than 30 possible ITS “user services.” VDOT has taken the liberty, as recommended in the National ITS Program Plan, to modify and group these services so they are specifically applicable to VDOT’s transportation responsibilities:

System Management

ITS services in the system management area support VDOT’s core mission in the areas of operations and management of traffic flow on VDOT facilities, maintenance operations, and the internal processes at VDOT.

Personal Travel Services

ITS services in the personal travel services area support travelers in all modes before and during their trip. It includes the provision of information and personal safety services that improve the total trip experience.

Commercial Vehicle Operations

ITS services that automate paperwork and processes for both commercial carriers, the Department of Motor Vehicles (DMV), and VDOT including credentialing, permitting, fee collection, weight and safety inspections, and load restrictions. Most Commercial Vehicle

Operations responsibility is now housed in the DMV.

Intelligent Vehicle Infrastructure

ITS services that automate or enhance the driver’s ability to safely navigate their route. Intelligent Vehicle systems can be found principally as equipment on vehicles, but may include supportive system elements in the roadway or roadside.

The following tables further describe the VDOT ITS services on which the agency will concentrate. The tables distinguish between those activities that are considered “**primary**” and those considered as “**support**” activities by VDOT.

- “**Primary Activities**” are activities that VDOT is responsible for developing, providing, operating or maintaining. These are the main focus of Smart Travel.
- “**Support Activities**” are activities for which VDOT assists another agency or group that has primary responsibility for the provision of the ultimate ITS service. VDOT can support others by providing data, technical support, space in VDOT facilities, coordination and/or cooperation.

The tables also note the likelihood of public-private partnerships in the provision of each ITS service. While this may change over time, it is intended to demonstrate where it is believed the opportunities for private sector participation lie.

System Management

ITS Service	Description	Example: VDOT <i>Primary Activities</i>	Example: VDOT <i>Support Activities*</i>
Traffic Control and Management	Includes systems that manage traffic movement on streets and highways (e.g., traffic signals and ramp meters)	<ul style="list-style-type: none"> • Traffic flow optimization • Traffic flow surveillance and detection • Reversible lane control • Data sharing for other purposes within and outside the agency and communications systems • Travel advisories via HAR and dynamic message signs 	<ul style="list-style-type: none"> • Support multi-agency integrated traffic operations
Incident Management	Helps public and private organizations identify the occurrence and nature of a highway incident, initiate the appropriate response, and clear the incident quickly. Usually includes video monitoring and inter-agency communications systems.	<ul style="list-style-type: none"> • Unplanned and scheduled incident identification, verification and traveler information via Internet, HAR and DMS • Rest area monitoring • Snow removal • Safety Service Patrol dispatch/response 	<ul style="list-style-type: none"> • Support emergency response coordination • Support incident clearance
Emergency Management	Provides management of transportation services in the event of natural or man-made disaster. Typically includes inter-agency communications systems.	<ul style="list-style-type: none"> • Monitor catastrophic events • Monitor transportation system during catastrophic events • Coordinate VDOT response 	<ul style="list-style-type: none"> • Support to multi-agency response
Demand Management	Supports policies and programs designed to mitigate the environmental and social impact of traffic and travel. Typically, current demand management programs seek to reduce the number of single occupant vehicles, especially during peak periods.	<ul style="list-style-type: none"> • Park and Ride Lots • HOV Lanes 	<ul style="list-style-type: none"> • Support ride matching • Support parking management • Support pricing strategies
VDOT Operations Management	Automates VDOT business processes including asset inventory and management, tracking maintenance activities, and customer service. Includes computerized databases, applications, and communications systems.	<ul style="list-style-type: none"> • Provide automated and automation-supported customer interface • Install systems to automate, manage and integrate maintenance and inventory activities 	

*VDOT supports other organizations in providing these services.

System Management (Continued)

ITS Service	Description	Example: VDOT <i>Primary Activities</i>	Example: VDOT <i>Support Activities*</i>
Archived Data Management	Automates statewide data collection, archiving and sharing for both internal VDOT and external customers.	<ul style="list-style-type: none"> • Smart Travel Lab • Archive historical traffic data e.g. volumes, speeds, and classification • Create ITS data interface among / between management systems including Integrated Maintenance Management Program (IMMP) • Archive historical incident data • Highway Traffic Research Information System (HTRIS) 	
Regulatory Functions	Promotes safer, more efficient enforcement of general traffic and vehicle regulations. Includes automated vehicle identification.		<ul style="list-style-type: none"> • Support HOV lane enforcement • Support toll violation enforcement • Support emissions law enforcement
Public Transit Management	Automates transit operations, planning and management. Generally includes fleet management systems and automated passenger message relay.		<ul style="list-style-type: none"> • Support transit schedule reliability • Support public transit security • Support Park and Ride lot information systems • Support flexible transit route strategies

*VDOT supports other organizations in providing these services.

Personal Travel Services

ITS Service	Description	Example: VDOT <i>Primary Activities</i>	Example: VDOT <i>Support Activities*</i>
Pre-Trip Traveler Information	Provides information to help select the best transportation mode and route	<ul style="list-style-type: none"> • Provide telephone traveler information • Provide Internet traveler information 	<ul style="list-style-type: none"> • Support private sector traveler information service ventures
En-Route Driver Information	Provides travelers with advisories and in-vehicle information for convenience and safety	<ul style="list-style-type: none"> • Provide telephone traveler information • Provide Internet traveler information 	<ul style="list-style-type: none"> • Support private sector traveler information service ventures that broadcast directly to in-vehicle devices.
Route Guidance	Provides travelers with simple instructions to reach their destinations	<ul style="list-style-type: none"> • Develop and update electronic state highway map 	<ul style="list-style-type: none"> • Support private ventures designed to provide en-route guidance
Electronic Payment Systems	Allows financial transactions to be accomplished electronically	<ul style="list-style-type: none"> • Smart Tag Program 	<ul style="list-style-type: none"> • Support development of an integrated, multi-modal electronic payment system
Emergency Notification and Personal Security	Allows motorists in emergency situations to contact aid directly from the vehicle		<ul style="list-style-type: none"> • Support private sector development of MayDay system
Traveler Services Information	Provides travelers with information on tourist attractions, parking, lodging, dining, fuel, etc.	<ul style="list-style-type: none"> • Logo signs • Scenic Roads in Virginia map 	<ul style="list-style-type: none"> • Support Virginia Tourism Corporation activities to improve tourist's travel experience

*VDOT supports other organizations in providing these services.

Commercial Vehicle Operations

ITS Service	Description	Example: VDOT Primary Activities	Example: VDOT Support Activities*
Electronic Clearance	Automates domestic and international vehicle clearance. Typical systems include transponders on vehicles and readers at weigh stations and other clearance points, as well as automated weigh stations.		<ul style="list-style-type: none"> Support activities of the DMV to automate clearance and promote transponders on commercial vehicles
Intermodal Connections	Enhances intermodal freight connections. Currently no systems are available appropriate for VDOT's needs.	<ul style="list-style-type: none"> Interface between roadway and other modes such as rail and water. 	<ul style="list-style-type: none"> Support other agency's efforts to provide intermodal interfaces
Administrative Processes	Automates domestic and international paperwork for permits and licenses. Components include Internet access to automated forms, and other forms of communications and paperwork automation.	<ul style="list-style-type: none"> Process electronic oversize/overweight 	<ul style="list-style-type: none"> Support other agency's efforts to automate paperwork for permits, licenses and fees.
Automated Roadside Safety Inspection	Enables targeted safety inspection and improves safety record access. Components include databases and communications systems.		<ul style="list-style-type: none"> Provide safety inspection facilities

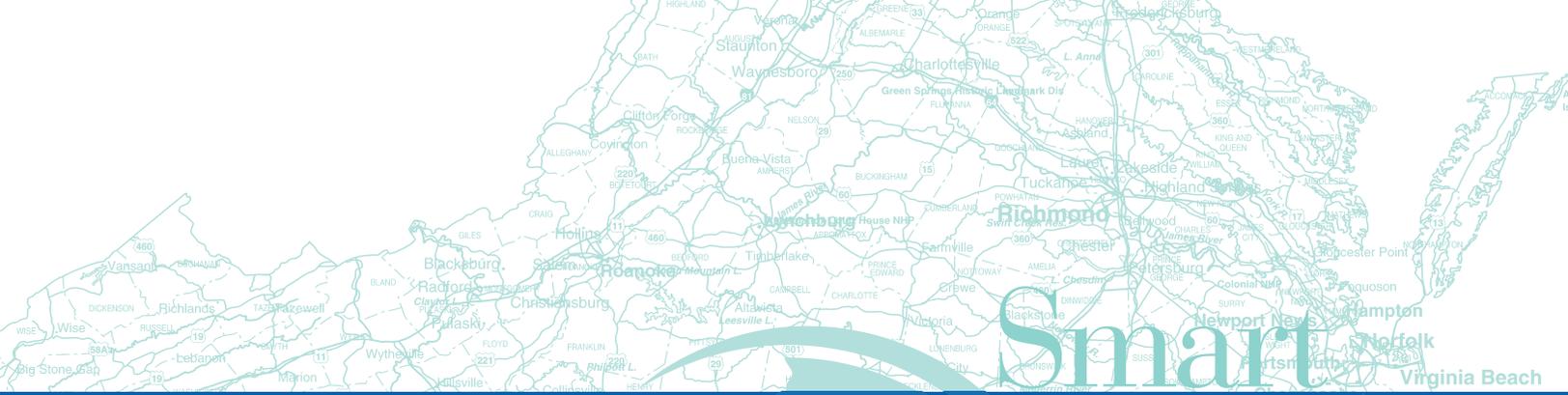
*VDOT supports other organizations in providing these services.

Intelligent Vehicle Infrastructure

ITS Service	Description	Example: VDOT Primary Activities	Example: VDOT Support Activities*
Intelligent Vehicle Initiative (IVI)	Development of “smart car” and “smart road” technologies that enhance navigation and safe operation of the vehicle.		<ul style="list-style-type: none"> • Support IVI through research contracts and facilities such as the Smart Road test center at VaTech. • Enable installation and testing of equipment that supports smart vehicles in VDOT right-of-way • Participate in research in support of VDOT activities (e.g., automation of maintenance vehicles)

*VDOT supports other organizations in providing these services.





PROGRAM VISION

“Intelligent Transportation Systems are changing the travel experience of highway users in Virginia.”



Intelligent Transportation Systems make travel “smart” through computers, microprocessors, high speed wire and wireless communications, and a host of supporting sensory and electronic technology, as well as through automated, streamlined agency processes and procedures. Together, these systems, technologies and processes are changing the travel experience of highway users in Virginia, as well as the way in which VDOT operations staff are able to more actively manage the highway system.

VDOT’s vision for the Smart Travel program takes an “umbrella approach” – encompassing the efforts of State and local governments as well as private sector entities to use advanced technologies to solve transportation problems and improve operations.

In fact, VDOT takes this approach one step further by actively pursuing regional coordination with other state transportation agencies in the Northeast Corridor. This is accomplished by participating in multi-state alliances and consortiums in the ITS arena such as the I-95 Corridor Coalition and Advantage CVO. This overall vision for the Smart Travel program will further solidify VDOT’s role as a leader in using innovative technologies and approaches to improve safety and mobility in transportation systems.

The Smart Travel Program Vision

Specific infrastructure is needed to provide services supportive of VDOT’s mission. This infrastructure is the foundation of the statewide Smart Travel program. Of course, it takes people – VDOT staff – to transform the infrastructure into services to travelers. Key components of ITS infrastructure include:

- **Detection** – Information on the transportation system must be gathered for processing, use in decision support, and dissemination to travelers.
- **Communications** – Communications infrastructure is required to move data through the system, and to support statewide integration.
- **Broadcast/Dissemination methods** – Accurate, timely information on conditions must be provided to travelers.
- **Processing** – Locations must be provided to house data processing and operations systems and software.

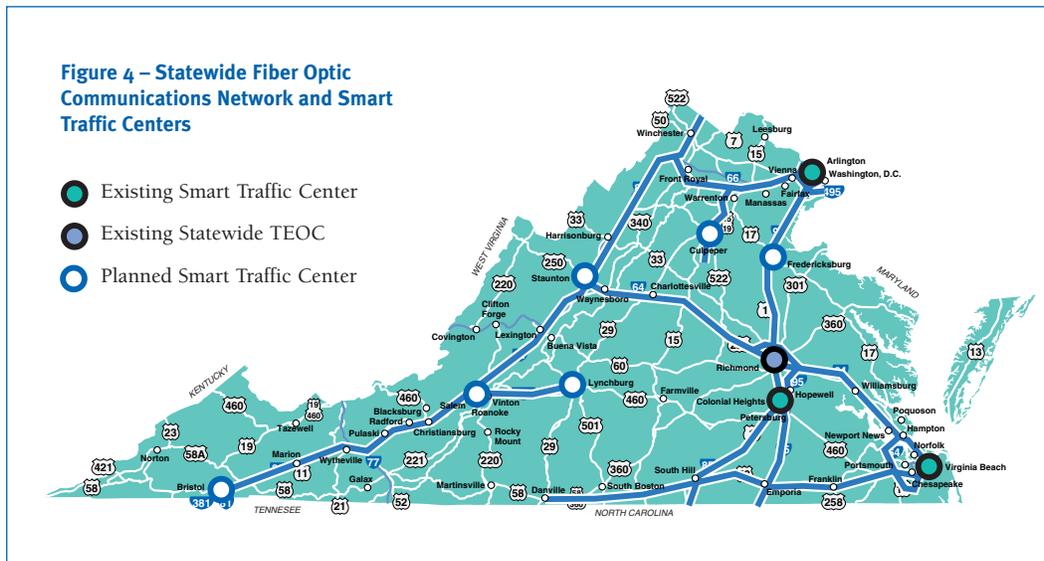
Given that foundation, the core elements of the envisioned statewide ITS infrastructure include:

- Smart Traffic Centers and the TEOC, as described in the Statewide Framework and shown in *Figure 4*.
- A statewide communications network, connecting the centers into an inte-

grated statewide system. *Figure 4* shows the planned statewide fiber optic network, which is being installed in a public-private partnership.

- To provide data to support the functions of the Smart Traffic Centers and District Operations Centers,

VDOT will provide complete instrumentation of Virginia's portion of the National Highway System to provide needed traffic volume, speed, classification and other information as needed to support planning, design, operations, and maintenance.



- A statewide network of public-private partnerships will be developed, resulting in a seamless statewide advanced traveler information system. *Figure 5* illustrates the concept.
- Commercial Vehicle Operations will be made paperless as VDOT and the

DMV install advanced internal systems. All weigh stations (*Figure 6*) will support this paperless operation, and will be upgraded and instrumented to allow trucks to process paperwork and be weighed without stopping.

Figure 5 – Statewide Advanced Traveler Information Partnerships

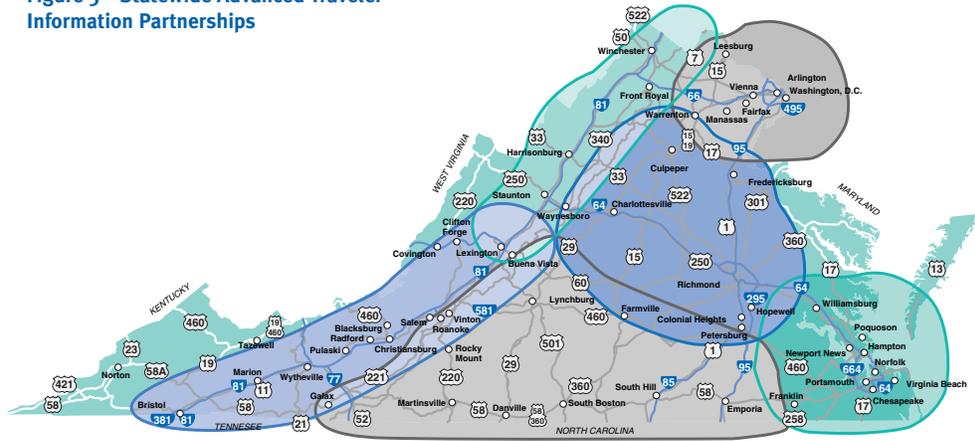
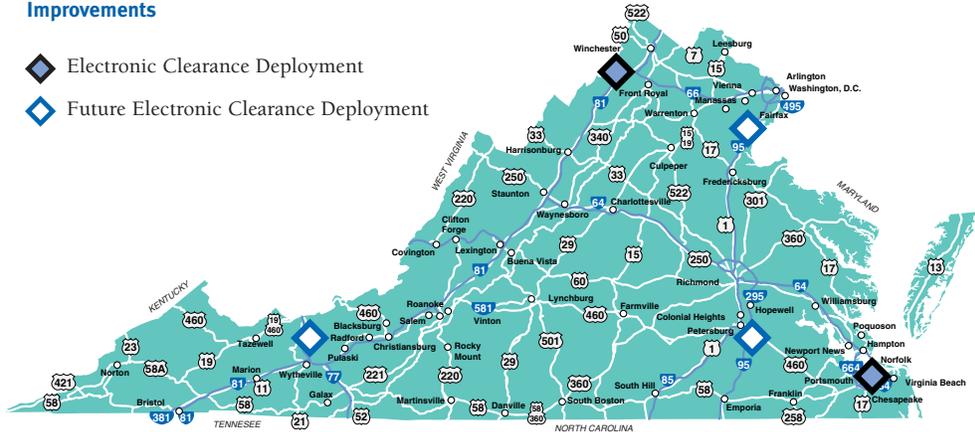
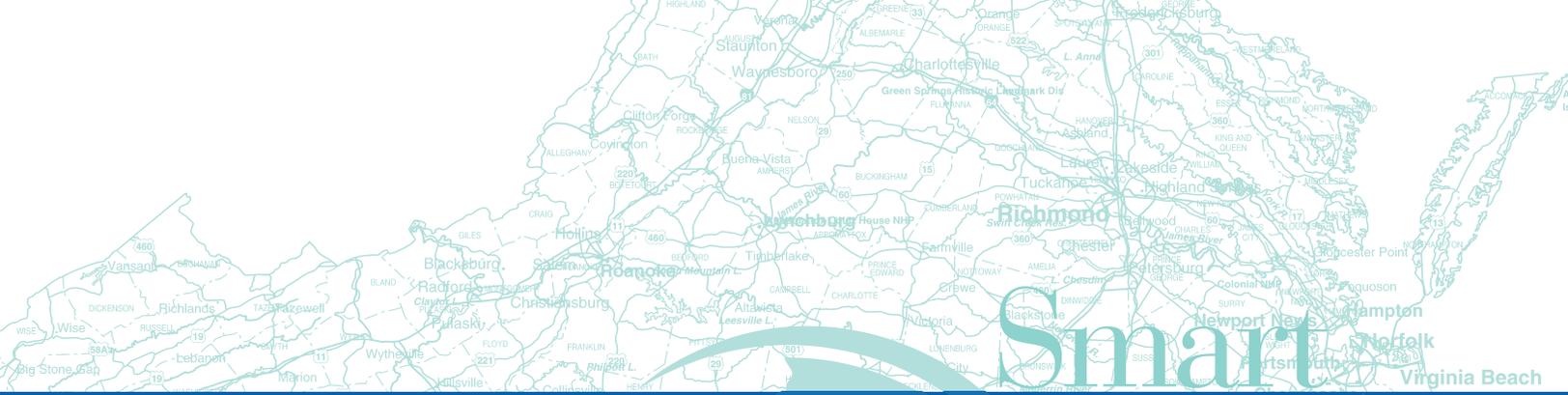


Figure 6 - Statewide CVO Weigh Station Improvements

- ◆ Electronic Clearance Deployment
- ◇ Future Electronic Clearance Deployment





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PROGRAM GOALS

“VDOT’s ITS goals support the overall mission and goals of VDOT.”



Overview

ITS is simply a set of tools that can assist transportation agencies in pursuing their mission and achieving their goals. VDOT's ITS goals support the overall mission and goals of VDOT.

VDOT has identified five goals for the ITS program:

Improve Highway Safety

Safety has always been, and must remain, the primary concern of transportation service providers. Reduction of the number and severity of crashes, and improving accident survivability via improved response is the highest priority in the deployment of ITS services.

Increase Mobility

Through ITS, VDOT will improve the movement of surface transportation, reduce recurrent and non-recurrent delays, and provide information that will help drivers make informed decisions. ITS will also increase access to all modes of transportation via information provision.

Enhance VDOT's Internal Productivity

In this day of limited government resources, it is critical that public agencies get the maximum return possible on every dollar invested in the provision of transportation services and infrastructure. VDOT puts significant emphasis on empowering its employees to do the best job possible to help make VDOT

the most effective transportation department in the country. ITS services will help VDOT employees become more efficient and productive.

Improve Transportation Service and Quality of Life for the Citizens of Virginia

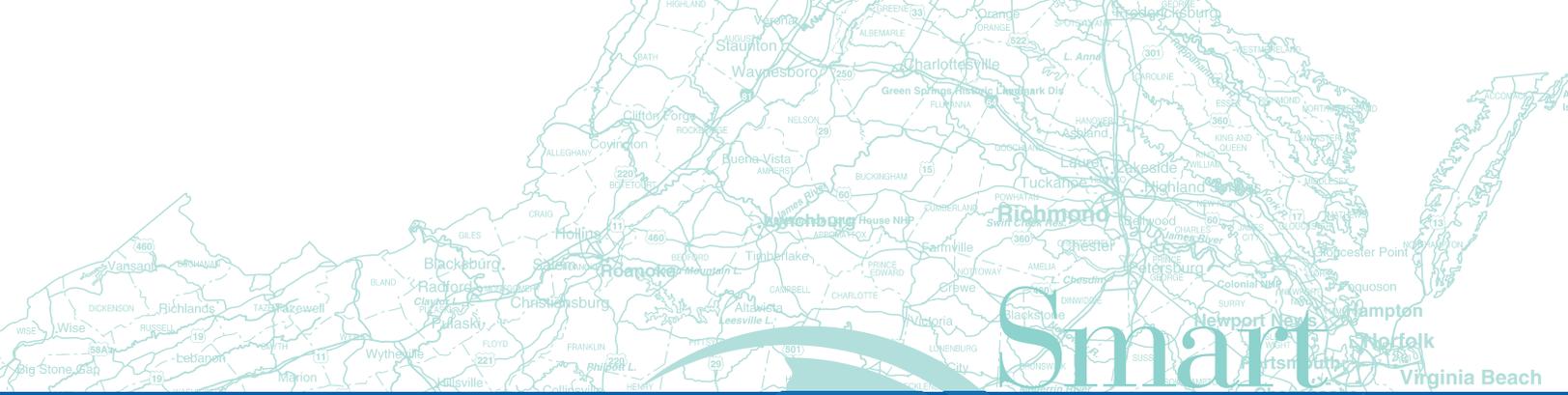
VDOT must continue to provide a transportation system that helps maintain a desirable quality of life for citizens of Virginia. At the same time, this system must continue to provide an adequate level of service for the safe and efficient movement of people and goods, with negligible negative impacts to the environment. In addition to traditional strategies of adding lanes and building new roads, ITS is another strategy that VDOT will consider when deciding how to address congestion, mobility and safety challenges. Because ITS focuses on operations and has a negligible impact on the environment, using ITS technologies, services and processes will help preserve the quality of life for all Virginians.

Support Economic Development

Transportation is a vital cog in the wheel of economic development. ITS can contribute towards economic development in three ways. First, it can help maintain a competitive economic environment by helping manage congestion. Second, it can help make Virginia a great place to do business, by enhancing VDOT's service-orientation. Automating commercial vehicle processes can remove lengthy,

unnecessary delays at weigh stations or cumbersome “red tape” when dealing with regulatory issues such as credentialling. Third, ITS creates a new market for technology, and can help attract high-technology businesses to Virginia.





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VDOT'S SMART TRAVEL PROGRAM

“VDOT’s approach is to identify services to meet current and future needs.”

Responding to Opportunities

This section describes Smart Travel program initiatives of statewide importance. As mentioned earlier, VDOT's primary transportation technology efforts focus on System Management and Personal Travel Services. VDOT takes a supportive or secondary role in Commercial Vehicle Operations and Intelligent Vehicle Infrastructure. The following sections detail VDOT's Smart Travel program activities in the primary work areas.

Good implementation comes from good planning, and VDOT is actively involved in technology planning and program development for ITS at all levels. ITS planning is intrinsically different from traditional transportation planning. Because of the fast pace of change in the technology arena, and evolving business models, we cannot look 10 or 20 years into the future and select technology solutions, which would be an exercise in applying today's technology to tomorrow's problems. Rather, our approach is to identify services to meet current and future needs, and to select technologies that supply those services in a dynamic and opportunistic way at the time of implementation. While a specific technology may not be envisioned today, the functions that must be performed can be and are included in our program vision.

One example of a technology change that has occurred only in the past three

or four years is in vehicle detection. The standard for detection has changed from technologies embedded in the pavement to non-intrusive radar or video-based detection. While VDOT carefully considers future needs in planning and program development at all levels, the Smart Travel program will remain flexible in order to take advantage of opportunities as they arise.

System Management

The core of the Smart Travel program has been and will continue to be System Management. The statewide approach leverages the implementations being developed and deployed at the Residency and District levels, and focuses on the elements that are critical to an integrated statewide system. Not only can VDOT systems be linked, but local agency systems can also be linked to the statewide network, if needed to support operations. Specifically, the statewide program focuses on:

- **Communications** – Without a communications backbone linking the local and regional systems, an integrated statewide network cannot be realized.
- **Software** – Software being developed and implemented at the local and District level must include provisions for integration in the statewide network.
- **VDOT Operations** – Various institutional issues that are common across VDOT hinder the ability to develop

the statewide integrated vision. Procurement barriers and organizational strengthening are the two most critical.

- **Research** – The statewide ITS Research program is developed annually and supports projects and systems in place and proposed throughout the state.

In addition, the ITS Division staff provide support to District or Residency ITS deployments statewide. This support includes statewide procurement of ITS systems and services, and diffusion of lessons learned. For example, the ITS Division has been instrumental in the development of regional traveler information partnerships with the goal of linking these regional services into a unified statewide network. The ITS Division has also provided technical training and information on deployments in other jurisdictions in a professional capacity building effort aimed at District staff.

The progress and plans for each of the program areas is described below, and summarized in the following migration path tables.

Telecommunications

Telecommunications is at the core of ITS. Without telecommunications, field data cannot be sent to the Smart Traffic Center for processing. A fiber optic network is needed to provide the capacity for data and video required to support improved operations. In addition, connecting the STCs requires a

telecommunications backbone. Telecommunications backbones are one of the most costly elements of ITS.

Recognizing this, the ITS Division has developed core guidelines for both fiber optic and wireless resource sharing with the private sector. With these guidelines as a resource, VDOT now has several major communications initiatives underway to provide telecommunications infrastructure.

- VDOT has entered into a statewide **public-private partnership** with a communications provider to exclusively install, operate and maintain more than **1,300 miles of fiber optic communications infrastructure** at no (cash) cost to the agency. As was shown on *Figure 4*, this fiber optic communications system will be located on selected Interstates and primaries. The private provider will have rights to use this right-of-way for commercial communication infrastructure development. In exchange for allowing this use, VDOT will be provided a fiber optic communications backbone for current and future ITS and traffic operations applications and services, saving the State millions of dollars today and in the future. Once this network is installed, VDOT will install or upgrade the Smart Travel instrumentation on the associated road facilities, which will move VDOT towards the goal of instrumenting the complete National Highway System in the state, providing the needed data to enable ITS services.

Key Elements of the System Management Migration Path

Previous Accomplishments	Current Program (0-2 Years)	Near Term (3-5 Years)	Long Term (6-10 Years)
STATEWIDE COMMUNICATIONS			
<ul style="list-style-type: none"> • Wireless Resource Sharing 	<ul style="list-style-type: none"> • Wireless Resource Sharing • Fiber Optic Resource Sharing 	<ul style="list-style-type: none"> • Wireless Resource Sharing • Fiber Optic Resource Sharing 	<ul style="list-style-type: none"> • Wireless Resource Sharing • Fiber Optic Resource Sharing
STATEWIDE SOFTWARE			
<ul style="list-style-type: none"> • NOVA Smart Signal System • NOVA Smart Traffic Center (STC) • Hampton Roads Smart Traffic Center (STC) • Richmond Smart Traffic Center (STC) 	<ul style="list-style-type: none"> • NOVA Smart Signal System Upgrades • NOVA STC Software Upgrades • Hampton Roads STC Software Upgrades • Staunton Smart Traffic Center (STC) 	<ul style="list-style-type: none"> • NOVA Smart Signal System Upgrades • Richmond STC Software Upgrades • Salem Smart Traffic Center (STC) • Bristol Smart Traffic Center (STC) 	<ul style="list-style-type: none"> • NOVA Smart Signal System Upgrades • NOVA STC Software Upgrades • Hampton Roads STC Software Upgrades • Staunton STC Software Upgrades • Salem STC Software Upgrades • Bristol STC Software Upgrades • 3 Remaining STCs
STATEWIDE OPERATIONS			
<ul style="list-style-type: none"> • Inventory Condition Assessment System (ICAS) • NOVA one-call customer telephone number Management Committee • Statewide DMS • VA Operational Info System (VOIS) • Automatic Vehicle Location for Safety Service Patrols • Statewide Incident Management Committee 	<ul style="list-style-type: none"> • Statewide DMS • (VOIS) Web-based upgrades • Statewide Incident Management Committee 	<ul style="list-style-type: none"> • Statewide Incident Management Committee • Archived Data User Service • Statewide instrumentation of the NHS • Statewide Integrated Maintenance Management Program 	<ul style="list-style-type: none"> • Statewide Incident Management Committee • Statewide Integrated Maintenance Management Program
RESEARCH			
<ul style="list-style-type: none"> • Smart Plow Demonstration • Bridge Deck Anti-Icing • Virginia Smart Travel Laboratory (STL) at U Va. • National ITS Implementation Center at GMU • Virginia's Smart Road 	<ul style="list-style-type: none"> • Real Time Adaptive Control System (RT-TRACS) • Capital Integrated Wireless Information Network (CAPWIN) • Traffic Simulation and Integrated Transportation Systems Management (ITSM) • Traffic Condition Forecasting for ITS Operations 		

- **Wireless resource sharing** has been underway throughout the state for several years. Wireless communication towers have been installed within VDOT's right-of-way in exchange for ITS devices such as CCTV cameras mounted on the towers, or other equipment installed in the vicinity of the towers. The wireless resource sharing program has resulted in the construction of more than 80 towers on state-owned right-of-way to date, yielding more than \$5 million in technology assets for the Department. The primary purpose of the program, however, is to ensure that the communications necessary to support the provision of public and private traveler information, route guidance and emergency notification services is present in Virginia. Advanced services, such as General Motor's OnStar, will not work in areas that do not have the communications infrastructure to support them. The wireless resource sharing program is designed to support the deployment of these systems in Virginia.

In the future, the Smart Travel program will focus on establishing more partnerships to support the communications needs of ITS, advanced vehicle information services, and completion of the statewide fiber optic network.

System Software

Each of the Smart Traffic Centers will have a software package developed specifically to meet local or regional needs. In addition, as needs and

technologies evolve, software upgrades will help VDOT maintain a high level of customer service.

Software specification and development is a time-consuming, detailed, difficult activity. To facilitate the development of software locally and regionally, VDOT has coordinated three statewide software activities.

- **VDOT-specific software functions** were developed in the statewide ITS Architecture project. Architecture is a computer system and software engineering term. An architecture describes how data flows throughout a system to perform specific functions. The architecture is essentially a menu of all the possible functions that VDOT supports. Districts, Residencies and regions can use the architecture as a starting point in the development of their own systems, selecting the specific functions they wish to provide. From that point, more detailed software development can begin, including the development of any special functions that must be supported at the specific location. Statewide functions such as data collection and archiving are also included in the architecture. The architecture saves time and resources for all VDOT in the development of software.
- VDOT is **investigating and evaluating software packages** developed for Smart Traffic Centers and installed at the Smart Travel Lab at the University of Virginia. Any other Smart Traffic Center may, if they choose, use

software developed and tested at another location. For example, NOVA is developing and testing leading edge applications in maintenance inventory and asset management. After successful deployment, this software may be used anywhere else in the state. In addition, software developed at the Smart Travel Lab can be used anywhere in Virginia.

In the future, a focus on site-specific safety applications will be included in statewide software and technology efforts.

VDOT Operations

As traffic management systems become more sophisticated and the demands for information from the public, from other agencies, and from the private sector increase, VDOT has realized a variety of impacts on the way the agency does business. VDOT has a long history in traditional road and bridge construction. Methods and processes developed in VDOT ably support those activities. However, high technology applications such as ITS do not have processes and methods developed specifically for them.

- VDOT has already moved forward in exploring **improved procurement methods**. Methods that have been instituted include “best value” procurements that combine cost and qualifications in the selection process, and task order procurements that support incremental project development approaches, as is required for software projects. Continued improvements in procurement are being explored that

will help VDOT project managers successfully manage complex software and system projects.

- In addition, statewide services are planned to include a **single – one call – customer service number for all public connections with VDOT**. This type of system was recently installed in NOVA. Other statewide services include a data archive, where data including traffic count, operations and performance will be stored and managed.
- A **statewide equipment and asset management system** that operates in real time is also part of the vision for VDOT. The Integrated Maintenance Management Program (IMMP) is VDOT's approach for achieving its vision for maintaining and operating the surface transportation system in Virginia. It includes people, processes, and tools involved in the Maintenance Program business. Through shared responsibilities, IMMP seeks to produce customer focused, cost effective results.

In the future, the Smart Travel program will place emphasis on developing ITS Plans in each VDOT District, and on the education and training of the new generation of VDOT ITS engineers, planners and managers.

While traffic congestion might seem an intractable problem, more than half of all traffic delays are due to “non-recurrent” events or incidents – events other than rush hour traffic. Such incidents include traffic crashes, vehicle breakdowns,

spilled loads, inclement weather or other emergency situations. While these events cause traffic disruptions, “rubbernecking” and inattentive driving can lead to secondary traffic collisions more severe and disruptive than the original event.

Incident management is a crucial yet complicated endeavor, because there is no one agency or entity with complete responsibility and capability to respond to and handle all incidents. Even though a roadway is owned and operated by VDOT, the emergency medical responder, law enforcement, and tow company depends on the jurisdiction involved. Detection of and coordinated response to incidents across jurisdictional boundaries is key to minimizing delays and secondary accidents.

- The **Statewide Incident Management committee** helps coordinate incident management activities across the state by providing a forum for the diverse responding agencies and VDOT. This committee is composed of a variety of players from other State agencies and institutions, as well as local jurisdictions, other States and private sector partners (such as AAA Potomac and the American Trucking Association).

Like every State, the Commonwealth of Virginia is vulnerable to disasters – both natural and human-induced. Natural disasters include severe weather events such as snowstorms and hurricanes, forest fires, landslides and flooding. Hazardous waste spills and industrial incidents are examples of disasters induced by human activity.

Transportation has always played a prominent role in emergency management functions during significant events. Disasters can, of course, disrupt transportation systems, requiring the response of VDOT construction forces to restore vital services.

- Because of transportation’s critical emergency management mission, it is natural that the Smart Travel program support this critical State function. The statewide **Transportation Emergency Operations Center (TEOC)** coordinates transportation emergencies for the entire State, and will be integrated with every Smart Traffic Center. TEOC serves as an interagency, statewide clearinghouse for construction, emergency, traffic and major incident information. The TEOC operates 24 hours a day, 7 days a week. When a major emergency event occurs, VDOT’s Smart Traffic Center managers will become a part of the State’s integrated response team, providing key executives, the media and the general public crucial transportation and roadway information. The TEOC will also be responsible for coordinating statewide equipment resources during major emergencies.
- The **Virginia Operational Information System (VOIS)** is an existing statewide interagency wide area network (WAN) which links Virginia State and Federal agencies together for information exchange. The information exchanged includes emergency management and operations activities. Participating agencies include VDOT, VSP, Virginia



Department of Emergency Services, Virginia National Guard, Virginia Department of Rail and Public Transportation and the National Weather Service (FHWA and FEMA in the future). VOIS is being updated for 2001. It will be a Web-based, user friendly information input and extraction tool.

Maintaining the momentum of the current incident and emergency management program will be a focus of the statewide Smart Travel program in the future.

Research

In the research arena, George Mason University (GMU), University of Virginia (UVa), and Virginia Tech (VaTech) are all supporting ITS research as is VDOT through its Virginia Transportation Research Council (VTRC). Key activities already in place include:

- The **VDOT Smart Travel Lab, co-managed by VTRC and UVa**. Supported by the VTRC, the Smart Travel Lab is a unique facility for research, evaluation and training in advanced transportation systems, including providing assistance with software development activities. They have developed a center where various operational schemes can be tested before they are applied in the field. Or, software can be modified at the center before it is installed to ensure it is robust and functions as needed. It currently is linked with the NOVA and Hampton Roads Smart Traffic Centers in real time.

- The **Smart Road at the Virginia Transportation Technology Institute** is a test-bed for IVI activities. Smart maintenance vehicles will be tested at the facility including technologies for improving ice and snow operations, and technologies that improve overall visibility while driving for VDOT staff and all travelers.
- The **National ITS Implementation Center, a consortium of GMU, UVa and VaTech**, is funded and dedicated to improving the success of high technology applications to transportation in Virginia and across the US.

The research programs will continue to explore new and innovative methods of providing ITS tailored to Virginia's needs.

Personal Travel Services

While System Management services are aimed at improving system operation and internal operations, Personal Travel Services are aimed directly at the traveler to improve the travel experience. These include Advanced Traveler Information Services (ATIS) and Electronic Payment Systems.

Advanced Traveler Information Systems – The Travel Virginia Program

In response to congestion or incidents, VDOT managers have an arsenal of traffic control devices and strategies to help manage the flow of vehicles through the system. A critical task involves information: distributing travel conditions to the public, so that individuals can make an informed choice about when to travel, what route to take, and whether or not transit service offers a better option.

- **Public-private partnerships in ATIS** began in the DC region with the Partners-In-Motion project, which is entering its fourth year of operations.
- Also in Northern Virginia, a **private sector partner is providing** motion video of traffic conditions over the internet.
- In Hampton Roads, a **traveler information public-private partnership** has just been launched.

- In the Staunton District, the **Travel Shenandoah ATIS project**, which is a **partnership** with VDOT, the National Parks Service, Shentel (the local telecommunications provider), the Virginia Tourism Corporation, and VaTech, is underway. The project is planned to be expanded to the complete I-81 corridor in the future.
- VDOT is currently investigating the feasibility and costs associated with **implementing a 511 telephone number** for providing **traveler information statewide**. The implementation of the 511 phone number is part of the Smart Travel program plan.

The statewide Smart Travel program will focus on continuing to develop partnerships with the private sector to realize the vision of delivering advanced traveler information services to the entire state. Regional partnerships will eventually be integrated together to form a statewide ATIS.

Key Activities of the Personal Travel Services Migration Path

Previous Accomplishments	Current Program (0-2 Years)	Near Term (3-5 Years)	Long Term (6-10 Years)
ADVANCED TRAVELER INFORMATION SERVICES			
<ul style="list-style-type: none"> Partners-In-Motion/SmartTraveler Travel Shenandoah – A Virginia Advanced Traveler Information System 	<ul style="list-style-type: none"> Hampton Roads Regional Advanced Traveler Information System 	<ul style="list-style-type: none"> I-81 Corridor Traveler Information Project Enhanced connection to private sector MayDay providers to 911 dispatch Implement statewide 511 traveler information telephone number. 	<ul style="list-style-type: none"> Complete ATIS coverage statewide Integrate regional ATIS into a seamless statewide network
ELECTRONIC PAYMENT SYSTEMS			
<ul style="list-style-type: none"> Smart Tag electronic toll collection – Dulles Toll Road and Powhite Parkway Extension Smart Tag on Coleman Bridge 	<ul style="list-style-type: none"> Smart Access integrated payment system Smart Tag on Rte 895 in Richmond 		<ul style="list-style-type: none"> Additional integrated payment systems

Electronic Payment Systems

Electronic payment systems ease congestion on toll facilities, and are very popular with drivers for their convenience. VDOT plans several projects to increase the diffusion of electronic payment systems.

- The **Smart Tag automated toll collection system** has been very successful in NOVA, on the Powhite Parkway Extension, and the Richmond Metropolitan Authority's Downtown Expressway. It will soon be operational on the metro Chesapeake Route 168 toll facility, on Route 895 in Richmond, and on Route 17 in York County. Smart Tag is planned to be diffused to other VDOT toll facilities in the state, as is now being accomplished on the Coleman Bridge, to allow Virginia travelers to pay tolls using the same toll tag across the state.
- A new project with the Washington Metropolitan Area Transit Authority (WMATA), called Smart Access, will investigate **integrating accounts** across tolls, transit payments, parking, convenience purchases and other payments. Rather than requiring that travelers hold multiple accounts, the system would provide a single balance sheet for all electronic payment transactions made by an individual.

Commercial Vehicle Operations

With the transfer of the truck weigh program to the Department of Motor Vehicles (DMV) in 2000, DMV now has responsibility for the great majority of CVO programs in Virginia along with the Virginia State Police (VSP) for safety inspections and VDOT for overweight permits.

DMV has initiated an update of the 1998 ITS/CVO Business Plan. VDOT support will be incorporated into that plan.

SUMMARY

The Virginia Department of Transportation has a far-reaching, statewide transportation technology program that concentrates on four key focus areas:

- System management
- Personal travel services
- Commercial vehicle operations
- Intelligent vehicle infrastructure

VDOT further clarifies that it has either a primary or secondary role in the implementation of activities in each focus area. VDOT's primary activities are in the system management arena – deploying systems to improve the safety and efficiency of the highway system. VDOT has more of a secondary role in the deployment of systems and services in the other three focus areas – relying on the private sector to take the lead in their implementation.

This Strategic Plan serves as a “blue print” for how the VDOT Smart Travel program will develop over the next ten years. A companion document, the Statewide Implementation Plan, will be developed in 2001 to provide further detail on the specific projects, costs and personnel needs to realize the vision for the future of transportation technology in Virginia.



VIRGINIA