



## **HAMPTON ROADS** Intelligent Transportation Systems

DRAFT FINAL REPORT

# **ITS Strategic Plan**

April 2004



*Submitted to | Virginia Department of Transportation  
Hampton Roads Planning District Commission*

*Submitted by | PB Farradyne Inc.*



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## EXECUTIVE SUMMARY

### **Why This Plan?**

A recent study by the Texas Transportation Institute (TTI) measured the average length of the daily weekday “congested rush hour” in Hampton Roads at 5.6 hours (6:00AM-9:30AM and 3:30PM-7:00PM). TTI estimated the aggregate cost of rush hour congestion at \$396 million per year, equating to an annualized per capita cost of \$261. Delay was estimated at 13 hours and wasted fuel at 22 gallons per person. The TTI assessment further noted that congestion in the Region continues to worsen — that merely maintaining Regional congestion at its current levels would require the addition of approximately 42 new lane miles of roadways (freeway and arterial) per year.<sup>1</sup>

This latter observation is significant because, in these times of fiscal austerity, substantial new road-building every year, for many years into the future, is not practical or likely. Therefore, in addition to funding occasional, realistic road-building and capacity-expansion activities, new, creative methods for improving the operational and performance efficiencies of the existing roadway and transit infrastructures must be identified and implemented.

A range of characteristics about Hampton Roads — geography, economic base, and current transportation practices — set the Region apart from others. The unusual geography of Hampton Roads, its specialized economic base, including the ports and the military, and its transportation “culture” help to explain current transportation conditions in the Region.

In another sense, however, Hampton Roads is not unique. As do all metropolitan regions, Hampton Roads encounters two types of congestion: recurring and non-recurring. Recurring congestion occurs when more vehicles travel on the highways than what those roads were designed to efficiently carry, leading to reduced speeds and congestion. This type of congestion is referred to as recurring because it tends to occur day-after-day, often at the same times and in the same locations.

Non-recurring congestion occurs due to factors such as automobile crashes, breakdowns, construction, and weather conditions. The table below highlights some of the differences between the two types of congestion. In the Hampton Roads Region, TTI estimates that 61% of total delay in the Region is due to non-recurring conditions, higher than the national average.

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<sup>1</sup> Texas Transportation Institute, Texas A&M University System, *Monitoring Urban Roadways in 2001: Examining Reliability and Mobility with Archived Data*, FHWA, 2003.

<b>Types of Congestion with Usual Mitigation Strategy</b>		
<b>Type of Congestion</b>	<b>Representative Causes of Delay</b>	<b>Mitigation Strategy</b>
<b>Recurring</b>	Infrastructure capacity shortfalls	Capacity increases
	Interchange bottlenecks	
	Weave and merge friction	Transportation Systems Operations and Management
	Non-optimized traffic signal timing*	
<b>Non-Recurring</b>	Breakdowns and crashes	Transportation Systems Operations and Management
	Construction work	
	Weather	
	Vehicle mix	

\* Note that while non-optimized signal timing will lead to recurring congestion, it is addressed through better operations and management, not new capacity.

In addition to factors such as wasted fuel and delay, non-recurring congestion often has a detrimental effect on safety. For example, automobile crashes often lead to secondary crashes with more severe effects than the first. Work zone alignments and weather can also lead to diminished safety. Therefore, non-recurring congestion must be addressed to eliminate or diminish the negative effects on mobility, safety, the environment, and the economy.

Intelligent Transportation Systems, or ITS, with its emphasis on projects that can be deployed reasonably fast and at moderate cost, continues to offer Hampton Roads an important part of the solution to the problem of worsening congestion. This Strategic Plan is thus a road map to effectively use ITS in the Region to improve the surface transportation system.

### **What are Intelligent Transportation Systems?**

ITS is the application of information, control, and communications technologies to surface transportation. When appropriately implemented and integrated into roadway and transit operations, ITS often improves the performance and efficiency of surface transportation, helping to:

- Ensure the mobility of people and goods,
- Provide for the safety and security of those people and goods,
- Improve overall transportation system operations, and
- Inform travelers and enhance user satisfaction.

ITS encompasses both technological and operational approaches to solving the challenges of surface transportation. While technology provides part of the solution, the deployment of ITS technologies often requires new, innovative ways of doing business — of working together across agency and jurisdictional lines to exchange and act on system-generated data and information. In this respect, ITS is not limited to technological strategies, but may include organizational and institutional activities that are capable of achieving new

operational efficiencies. Some experts now look at ITS under a broader concept known as Transportation Systems Operations and Management (TSOM).

### **What is Transportation Systems Operations and Management or TSOM?**

Over the past 30-40 years, transportation practitioners have worked through different approaches to improving operations and management of the transportation system. These developments are sometimes conceptualized as follows:

<b>Generations of Thinking and Associated Strategies</b>	
<b>Generation of Thinking</b>	<b>Strategies</b>
First Generation	<ul style="list-style-type: none"> <li>• Transportation Systems Management (TSM)</li> <li>• Congestion Management Systems (CMS)</li> </ul>
Second Generation – ITS-focused	<ul style="list-style-type: none"> <li>• ITS early deployment plans</li> <li>• ITS master plans</li> <li>• Long-range ITS plans</li> </ul>
Third Generation – New state-of-the-practice	<ul style="list-style-type: none"> <li>• Transportation system operations and management (TSOM)</li> <li>• Built around ITS</li> </ul>

For purposes of this Plan, TSOM -- part of the current or Third Generation -- is defined as:

*Active management of the existing transportation system to maintain customer-focused performance in the face of congestion, incidents, and other service disruptions.*

While TSOM is built around ITS, ITS is not seen as the solution. Rather ITS is now viewed as providing core technologies to enable active management and operation of the transportation system.

Typical differences between the Second and Third Generations are reflected in the following table:

### **Differences Between Second and Third Generations of ITS**

<b>Second Generation ITS</b>	<b>Third Generation ITS</b>
Focus on projects	Focus on performance
Capital budget consensus	Operations consensus and commitments
Constrained by capital costs	Concerned with operating costs (e.g., staffing, equipment maintenance)
State DOT's and local traffic/public works departments	Transportation (including transit) and public safety entities (and private sector)
Priority on architecture	Priority on concepts of operations as well as architecture
Technology is the solution	Service – using technology as a tool – is the solution
MPO leading planning	MPO convening forum(s) for operational consensus

The driving forces behind the Third Generation transportation systems operations and management strategy are several including increasing traffic congestion and resource constraints on construction of new capacity. Others include:

- Higher expectations and demands for increased accountability from the public for better system performance,
- Increasingly better understanding of the causes of traffic congestion and travel delay, as well as cures to minimize congestion and improve travel time reliability,
- Availability of more tools to operate and manage the system,
- Heightened emergency management/security needs,
- Environmental requirements,
- Special circumstances such as regular special events, and
- Desire for increased safety.

### **Regional TSOM/ITS Challenges**

One city traffic engineer noted during a forum for this project that the agencies and jurisdictions in the Hampton Roads Region have been sharing information but essentially acting independently in their ITS and operations and management activities. The time is coming, this participant said, when agencies and jurisdictions within the Region will need to integrate their activities to provide the best possible transportation system to the Region.

The long-range 2026 Plan also notes that one of the Region's top priorities should be "one inter-connected Region." This can be interpreted in many ways, including the following:

- Complete physical transportation network with no significant gaps,
- Multi-modal connections that enable cross-modal travel or traffic, and
- Complete transparency when it comes to sharing transportation-related information of importance to multiple agencies and jurisdictions.

It is this last thought to which the city traffic engineer was referring.

The nature of systems — whether transportation networks or information technology systems — is such that they must be viewed in their entirety to be understood and properly utilized. The Hampton Roads Region is making progress in terms of viewing transportation from a systems perspective. However, the crosscutting nature of a transportation system (and subsystems) tends to cut across conventional decision-making. While this complicates the attainment of an overall perspective, it must not stand in the way of doing so. Otherwise, end users — all travelers and other users of the transportation systems — suffer.

Another regional priority — as enunciated in the 2026 Plan — is maintenance. In addition to maintaining pavement, bridges, transit buses, and other components of the transportation infrastructure, a focus on operations and management of the existing system is an important part of both maintaining — and effectively utilizing — the existing system and its capacity. Section 4.0 lays out additional regional challenges described by Hampton Roads stakeholders during outreach for this Plan.

### **What This Plan Does**

The Hampton Roads Region already operates a robust ITS program that focuses on improved freeway and arterial management. There now exists the need and desire to expand the scope and magnitude of the ITS program. Towards this end, a Strategic Plan has been established to support the expanded effort. Essentially, this Plan advocates a three-pronged approach to ITS and enhanced operations and management in the Hampton Roads Region:

- Implement quick fixes identified through the Strategic Plan working group sessions as soon as possible,
- Plan for, and implement, a phased set of ITS projects under six program areas starting with ongoing projects and extending over a much longer period of time, and
- Change the institutional parameters within which the transportation community works so that more emphasis is placed on transportation system operations and management.

More specifically, the ITS strategic plan is designed to:

- Maintain the implementation momentum by completing the current projects and extending their coverage throughout the Region.
- Move from disparate ITS projects towards an integrated Regional program.
- Identify immediate action priorities prompted by the higher level of Regional consciousness and concern about emergencies, including both security- and disaster-related emergencies.
- Leverage the on-going ITS and capacity project investments with a focus on defining the operational strategies and protocols, negotiating the needed inter-jurisdictional agreements, obtaining the necessary staff and capital resources, etc.
- Shift the Regional transportation focus to an “operational” paradigm.
- Identify and implement the logical next steps in ITS implementation, building on the existing investments and experience to ensure cost-effective improvements.
- Define affordable, doable next steps, consistent with reasonable expectations regarding level of investment and staff support.

- Coordinate the implementation of interdependent ITS projects and activities.

The underlying theme of this Strategic Plan is that Hampton Roads can improve its focus on efficiently and effectively operating and managing its transportation system. The recommendations in the Plan address important elements necessary to sharpen this focus. Throughout the Plan, the presumption is that activities are proposed from a regional, not a local, perspective. However, aspects of these activities can and should be adopted at the local level, i.e., by the single jurisdictions, as well.

### **Development of This Plan**

Some of the parameters established for development of this Plan included:

- Building on previous ITS planning,
- Reaching out to existing and new stakeholders, especially emergency management stakeholders,
- Reviewing, updating, and validating integral components of the Regional ITS Architecture,
- Updating the Regional ITS projects/operational initiatives inventory,
- Identifying near-term ITS/operational strategies,
- Establishing a compelling Regional vision for ITS,
- Furnishing inputs to the 2026 Long-Range Plan,
- Identifying procedures for maintaining the Strategic Plan, and
- Improving services, responsiveness, and accountability to customers.

Major outreach for the Plan included:

- A strategic planning workshop held in June 2003,
- Fact-finding site visits to jurisdictions/agencies,
- Briefings and discussions at several Hampton Roads ITS Committee meetings,
- Briefing and discussion at the Hampton Roads Transportation Technical Committee to present the 2026 Plan inputs, and
- Six working group sessions with a range of stakeholders.

Through these outreach activities, much raw input for this Plan was obtained and then fashioned into a structure suitable to a Strategic Plan.

### **Organization of This Plan**

The fundamental structure of this Plan is based on six program areas. These six areas serve to focus the Region's efforts on a discrete number of programs, which are areas where significant challenges and needs were identified. These challenges and needs are described in Section 4.0. New and planned projects should correspond to these six program areas, and a Strategic Vision for projects from now through the 2026 horizon is set out in Section 5.0. Some projects may well fit into more than one area. The six program areas are as follows:

**Systems Integration** — Upgrading communications for data and voice systems, both automated and real-time, to maximize management and responsiveness.

**Incident and Emergency Management** — Improving detection, management, and information dissemination for traffic incidents and other emergencies.

**Transportation Management** — Improving the control and operation of freeways, arterials, and bridge-tunnels on an integrated, inter-jurisdictional, and traffic-responsive basis.

**Systems Management** — Installing components to monitor and detect the status of traffic, physical roadway systems, and vehicle operational systems.

**Traveler Information** — Deploying systems to provide timely and decision-critical travel information to travelers planning trips and en-route.

**Program Development and Management** — Developing support for effectively reaching consensus on ITS policy, deploying cost-effective and standardized systems, monitoring and maintaining system performance, and institutionalizing good practices.

The last program area, Program Development and Management, recognizes the need for organizational and institutional modifications to make this Plan and its Strategic Vision a reality. It supports the other five program areas. Section 7.0 in the Plan also focuses on implementation strategies that may be helpful in moving this Plan forward.

### **ITS Strategic Vision**

Section 5.0, which proposes and describes key regional projects, is, as noted above, organized by program area. It is further segmented by the following timeframes:

- Rapid-Term: 2004-2005,
- Near-Term: 2004-2009,
- Mid-Term: 2010-2017, and
- Long-Term: 2018-2026.

The table, on the following pages, shows the recommended projects and the timeframes in which they could be implemented.

**Milestones by Program Area and Time Interval**

<b>Program Area</b>	<b>Milestones and Time Intervals</b>		
	<b>Near-Term: 2004-2009</b>	<b>Mid-Term: 2010-2017</b>	<b>Long-Term: 2018-2026</b>
<b>Systems Integration</b>	<ul style="list-style-type: none"> <li>○ Establish a Regional Multimodal Management System (RMMS) baseline infrastructure to ultimately serve as the data repository and information-exchange gateway for regional ITS activities.</li> </ul>	<ul style="list-style-type: none"> <li>○ Implement an advanced RMMS by integrating additional regional systems with RMMS, e.g., Virginia State Police computer-aided dispatch.</li> </ul>	<ul style="list-style-type: none"> <li>○ Implement analytic &amp; predictive RMMS modeling, enabling the ability to prospectively address and manage traffic problems before they occur.</li> </ul>
<b>Incident &amp; Emergency Management</b>	<ul style="list-style-type: none"> <li>○ Define an incident management and emergency management concept of operations to ensure smooth transportation and emergency management coordination.</li> <li>○ Integrate VDOT Smart Traffic Center with Virginia State Police computer-aided dispatch system for traffic and incident data exchange.</li> </ul>	<ul style="list-style-type: none"> <li>○ Integrate each city smart traffic center with that city's police computer-aided dispatch system.</li> <li>○ Develop real-time data messaging service for emergency responders (including transportation).</li> </ul>	<ul style="list-style-type: none"> <li>○ Integrate city police computer-aided dispatch systems with RMMS.</li> </ul>

<b>Program Area</b>	<b>Milestones and Time Intervals</b>		
	<b>Near-Term: 2004-2009</b>	<b>Mid-Term: 2010-2017</b>	<b>Long-Term: 2018-2026</b>
<b>Transportation Management</b>	<ul style="list-style-type: none"> <li>○ Complete final phase (Phase 3) of VDOT Freeway Management System deployment.</li> <li>○ Complete ongoing VDOT Smart Traffic Center integration and software development.</li> <li>○ Complete and make operational smart traffic centers in major cities.</li> <li>○ Enhance traffic detection through integration and synthesis of traffic data from VDOT, major cities, and Hampton Roads Transit (HRT). Link synthesized data to RMMS.</li> </ul>	<ul style="list-style-type: none"> <li>○ Implement predictive and response capabilities by: <ul style="list-style-type: none"> <li>▪ Continuing build-out of centrally controlled city traffic signal systems,</li> <li>▪ Adding algorithms to predict freeway and major arterial traffic, and</li> <li>▪ Developing automated responses to traffic conditions.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>○ Implement adaptive systems for VDOT's Freeway Management System and the cities' smart traffic signal systems to enable automated real-time response to freeway and arterial traffic conditions.</li> </ul>
<b>Systems Management</b>	<ul style="list-style-type: none"> <li>○ Perform an assessment of Region-wide transportation assets. Determine mission-critical assets and plan for backup. Automate asset inventory process.</li> <li>○ Install automatic vehicle location (AVL) systems on HRT buses, Freeway Incident Response Team (FIRT) vehicles, and VDOT maintenance vehicles.</li> <li>○ Implement automated detection and warning systems for over-sized commercial vehicles. Determine where other detection and warning systems may be needed in the Region.</li> </ul>	<ul style="list-style-type: none"> <li>○ Expand fleet management capabilities by expanding AVL vehicle coverage. Integrate AVL with other transportation management systems, e.g., transit scheduling and vehicle diagnostic systems.</li> <li>○ Plan for, and deploy, automated enforcement management programs, e.g., red light, speed limit, and HOV violation detection and enforcement.</li> </ul>	<ul style="list-style-type: none"> <li>○ Integrate asset and fleet management systems to enable real-time "visibility" of major assets, e.g., bridges and vehicles, through the RMMS.</li> </ul>

<b>Program Area</b>	<b>Milestones and Time Intervals</b>		
	<b>Near-Term: 2004-2009</b>	<b>Mid-Term: 2010-2017</b>	<b>Long-Term: 2018-2026</b>
<b>Traveler Information</b>	<ul style="list-style-type: none"> <li>○ Implement basic 511 service for dissemination of transportation information via phone and web. Revitalize regional advanced traveler information system (ATIS) to include expanded video-sharing and highway advisory radio.</li> </ul>	<ul style="list-style-type: none"> <li>○ Link RMMS to 511/ATIS services to expand the type, sophistication and dissemination of data including HRT passenger information.</li> </ul>	<ul style="list-style-type: none"> <li>○ Complete the data-fusion capability in RMMS and "pump" fused data to 511/ATIS services. Expand dissemination capabilities, e.g., more use of wireless communications and interfaces with in-vehicle systems.</li> </ul>
<b>Program Development &amp; Management</b>	<ul style="list-style-type: none"> <li>○ Expand efforts to communicate an awareness of the operational benefits of ITS to community leaders and the public. Enhance training for ITS staff. Establish a regional ITS and Operations Standards Group to define data-exchange and other technical standards.</li> <li>○ Adopt regional configuration management procedures and standards.</li> </ul>	<ul style="list-style-type: none"> <li>○ Establish a regional maintenance staff for ITS.</li> </ul>	<ul style="list-style-type: none"> <li>○ Implement a structured systems migration process for upgrade and replacement of aging ITS equipment.</li> </ul>

Of course, as ever more-distant projects are defined, descriptions of those projects grow increasingly speculative. Nevertheless, the Strategic Vision gives a sense of where the Region should head to obtain a consistent return on transportation investments both in the near- and long-term. The Strategic Vision also describes some very near-term projects, called Rapid-Term Solutions, that could be implemented by the end of 2005 and provide early benefits to the Region.

### **Hampton Roads and ITS: Transitioning to the Next Level**

As compared to other regions across the country, Hampton Roads has long been on the leading edge of ITS planning efforts. The Region pioneered development of an Early Deployment Plan, as presented in the 1995 report entitled *COMPARE: Congestion Management Plan — a Regional Effort*. The Region was also an early adoptee of an ITS Regional Architecture. The Region is presently engaged in significant ITS activities and projects. There is a strong partnership between VDOT and the Region, and a comfortable relationship among the Region's ITS stakeholders.

In many ways, the Hampton Roads Region is one of the most advanced in the nation. It has:

- Some of the first and more complete ITS plans in the nation — *e.g.*, early deployment plan, master plan, major investment study, and other plans;
- A leading metropolitan planning organization, the Hampton Roads Planning District Commission, in terms of its commitment to ITS and to data collection to demonstrate costs and benefits;
- An active ITS Committee which has provided Regional leadership over the years;
- A sophisticated Freeway Management System with the Smart Traffic Center as the hub;
- Planned or deployed state-of-the-art centrally controlled traffic signal systems with municipal smart traffic centers; and
- A far-reaching plan through Hampton Roads Transit to initiate several projects to deploy ITS services.

Now, Hampton Roads, building on a strong base, has the opportunity to move to the next level. This requires a Strategic Vision, which this Plan provides. It also requires a Regional commitment, as the programs and implementation steps outlined in this document cannot be achieved by continuing the existing practices.

In fact, implementation of this Plan will require higher-level political commitments, as well as additional resources, especially more and better trained staff. Existing staffing levels are sufficient to meet the status quo, but not the heightened expectations set by this Plan. Therefore, consideration must be given to attracting and paying for more staff with the expertise to assist the Region in moving forward. On the funding side, project allocations

have already been reflected in the Region's long-range 2026 Plan and are presumed to be available for purposes of this Plan.

Adoption of this Plan — with the resources behind it — will enable the Region to move to the next level in creating a superbly operated and managed surface transportation system. This system will, in turn, provide the Region with enhanced mobility, safety and security, and more satisfied users — goals to which all metropolitan regions aspire.

## 1.0 BACKGROUND

The population and economic center comprising southeastern Virginia — and referred to in this report as the Hampton Roads Region — has long distinguished itself as a pioneer in the implementation of *Intelligent Transportation Systems* (ITS). Under the auspices of a regional planning organization, the Hampton Roads Planning District Commission (HRPDC), the Region maintains a standing ITS Committee to oversee, guide, and coordinate the adoption and implementation of cross jurisdictional ITS initiatives. Additionally, the Virginia Department of Transportation (VDOT) operates a permanent Smart Traffic Center (STC) in Hampton Roads to monitor and manage conditions on the Region's interstate roadways, and identify and coordinate responses to incidents as they occur. A strong, generally cooperative relationship exists between VDOT and municipal traffic, transit, emergency response, law enforcement, and inter-jurisdictional agencies across the Region.

Hampton Roads, in 1995, spearheaded the development of a Regional ITS Architecture, which defined the ITS interconnections and information flows among the Region's transportation stakeholders. The Region was also an early adoptee of an ITS Strategic Plan, first developed in 1995 and subsequently modified in 2000.

Since modification of the Strategic Plan, much has changed across Hampton Roads. The transportation needs and demands of the Region have continued to evolve. Several significant regional and statewide transportation initiatives have been undertaken and important marketplace technologies have matured. Also, stiff constraints on funding and resources have had major impacts on transportation decision-making at the state, regional, and local levels. For these reasons and others, the Hampton Roads ITS Committee determined that a new update of the Strategic Plan was both necessary and desirable.

The current update of the ITS Strategic Plan was begun in March 2003 and completed in April 2004. It was performed by PB Farradyne, an ITS planning and services firm, on behalf of HRPDC and VDOT. The Hampton Roads ITS Committee oversaw and guided the update process.

### 1.1 ***Intelligent Transportation Systems***

*Intelligent Transportation Systems* refers to the application of information, control, and communications technologies to surface transportation. When appropriately implemented and integrated into roadway and transit operations, ITS often improves the performance and efficiency of surface transportation, helping to:

- Ensure the mobility of people and goods,
- Provide for the safety and security of those people and goods,
- Improve overall transportation system operations, and
- Inform travelers and enhance user satisfaction.

ITS encompasses both technological and operational approaches to solving the challenges of surface transportation. While technology provides part of the solution, the deployment of

ITS technologies often requires new, innovative ways of doing business — of working together across agency and jurisdictional lines to exchange and act on system-generated data and information. In this respect, ITS is not limited to technological strategies, but may include organizational and institutional activities capable of achieving new operational efficiencies

## **1.2 Utility of ITS**

ITS applications — when clearly defined, properly implemented, and optimized for performance — are capable of advancing the safety, efficiency, and security of the surface transportation system; increasing access to transportation services; and reducing fuel consumption and adverse environmental impacts.<sup>2</sup>

Several more specific ITS benefits are summarized below:

- *ITS Improves Operations.* In recent years, transportation policymakers have increasingly recognized the importance of effectively operating and managing the existing transportation infrastructure. Of course, merely building a highway network or placing transit buses on the streets will not, in and of itself, guarantee efficient utilization of — or high-quality service from — the roadway or transit system. However, well-planned operations and management techniques, such as utilization of the monitoring and control systems associated with many ITS deployments, helps ensure that transportation systems maximize mobility and promote safety. State-of-the-practice technologies, when deployed on roadways and transit systems, are capable of significantly improving travel-time reliability.
- *ITS Reduces Congestion.* Congestion is generally the result of either “recurring” or “non-recurring” conditions. Recurring congestion is almost always predictable, e.g., rush hour traffic, and is due to causes such as capacity shortfalls, interchange bottlenecks, poor signal timing, etc. Non-recurring congestion usually results from causes that are more intermittent and less predictable, e.g., vehicle crashes, poor weather conditions, construction and work zone activity, special events, etc. Non-recurring congestion, the principal source of travel unreliability, constitutes approximately 50 percent of the total delay in many metropolitan regions.<sup>3</sup> ITS is particularly useful in addressing non-recurring congestion by anticipating and remedying the conditions that cause incidents and delay. ITS enables system managers to promptly identify incidents when they do occur, to coordinate rapid response to incidents, and to communicate information about conditions to travelers, including strategies for navigating around or through the delay.
- *ITS is Cost-Effective and Time-Efficient.* When contrasted with the cost of enhancing roadway infrastructure capacity — e.g., widening a highway — most ITS solutions are comparatively inexpensive to deploy, often requiring only a fraction of the budgets necessary to support large-scale construction activities. Indeed, in the

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<sup>2</sup> Intelligent Transportation Society of America and the U.S. Department of Transportation, *National Intelligent Transportation Systems Program Plan: A Ten-Year Vision*, 2002; p. 1.

<sup>3</sup> Federal Highway Administration, Office of Operations; <http://ops.fhwa.dot.gov/congestionmitigation/congestionmitigation.htm>.

current climate of constrained fiscal resources, there is an acute need to achieve measurable service improvements at modest cost and within short timeframes, say, three to five years. ITS solutions can frequently be crafted to meet these goals.

- *ITS Supports Long-Range Planning.* ITS-based operational and technology solutions, when coupled with more traditional plans for increasing infrastructure capacity, can yield a balanced, comprehensive strategy for serving the transportation needs and interests of a Region over the long-term.

Regions across the nation are increasingly discovering the utility of making ITS an integral component of their long-range transportation planning processes.

### **1.3 Transportation in the Hampton Roads Region**

Hampton Roads, in southeastern Virginia, refers to the landmass where the Elizabeth, James, and Nansemond rivers empty into the Chesapeake Bay. The Region stretches from the banks of the Atlantic Ocean, northwestward across the Chesapeake Bay, to Williamsburg. It encompasses the cities of Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg and the counties of Gloucester, Isle of Wight, James City, Southampton, Surry, and York. The Region is permeated by a labyrinth of waterways, with the Chesapeake Bay and James River dividing the area into two distinct landmasses — referred to as the Southside and Peninsula, respectively. One bridge and two bridge-tunnels link the Southside to the Peninsula. Given its naturalistic, “harbor-like” features, Hampton Roads houses a range of port and docking facilities. The Region hosts a strong military, shipbuilding, and seaport presence and is a major east coast tourist destination.

The Hampton Roads metropolitan statistical area (MSA), with a population of approximately 1,570,000 people in 2000, ranked 30<sup>th</sup> largest in the nation in terms of population size.<sup>4</sup> The Region's population grew by 20 percent between 1980 and 1990; however, the rate of growth slowed to 9 percent between 1990 and 2000, even though the state and national population growth rates during the same decade were 14 percent and 13 percent, respectively.<sup>5</sup> Also, in 2000, the population in Hampton Roads was younger (median age: 33.6 years) than the comparable state and national populations (median ages: 35.7 and 35.3 years, respectively).<sup>6</sup> The 1999 per capita income for the Region (\$20,328) was moderately lower than the state and national averages (\$23,975 and \$21,587, respectively).<sup>7</sup>

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<sup>4</sup> U.S. Census Bureau, *Statistical Abstract of the United States: 2002*; p. 33.

<sup>5</sup> Looking at aggregate Regional population growth rates only does not tell the complete story, since growth across the Region fluctuated markedly by jurisdiction. For example, for the period 1990-2000, Norfolk — one of the largest, established jurisdictions in the Region — saw its population decline by 10 percent. This contrasts with population increases in Virginia Beach (+8%), Suffolk (+22%), Chesapeake (+31%), York County (+33%), and James City County (+38%) over the same 10-year period.

<sup>6</sup> U.S. Census Bureau, *Census 2000*, Summary File 1.

<sup>7</sup> U.S. Census Bureau, *Census 2000*, Summary File 3.

The Hampton Roads Region is crisis-crossed by a sophisticated transportation network that includes Interstates 64, 264, 464, 564, and 664, plus numerous additional U.S. and state routes; a series of bridges and bridge-tunnels connects the disparate parts of the Region across a multitude of waterways. VDOT oversees construction and maintenance on 820 lane-miles of interstates, 2,070 lane-miles of primary roads, and 7,830 lane-miles of secondary roads across the Region; many miles of additional roads are maintained by the local jurisdictions. The total length of public roadway segments — not lane miles — across the Region is approximately 7,900 miles. Collectively, these roads support daily vehicle miles of travel (DVMT) of 37.6 million.<sup>8</sup>

Hampton Roads Transit (HRT) operates the Region's largest public transportation system and currently furnishes services within and between the cities of Norfolk, Virginia Beach, Chesapeake, Portsmouth, Hampton, Newport News, and Suffolk. HRT operates a fleet of approximately 280 buses, 147 on-demand para-transit vehicles, 41 vanpool vehicles, and four ferryboats. HRT furnishes approximately 81.6 million passenger miles of travel per year.<sup>9</sup>

The unusual geography of Hampton Roads, its specialized economic base, and its transportation "culture" help to explain current transportation conditions in the Region. Some of the most important characteristics that impact conditions and performance are identified below:

- Limited roads in and out of the Region,
- Large numbers of waterways across the Region,
- Access over waterways using a limited number of bridges and tunnels,
- The Region is subject to major storms and flooding,
- Heavy military base activity,
- Heavy ports activity,
- High-volume of freight movements to and from the Region,
- Major tourist destination,
- Large numbers of special events are held across the Region,
- The Region is widely viewed as a potential terrorist target,
- Key Eastern Seaboard evacuation routes pass through the Region,
- Traffic often backs up from freeways onto arterials,
- Conversely, traffic sometimes backs up from arterials onto freeways,
- Incidents in tunnels and on bridges tend to cause major delays,
- Heavy dependency on travel by personal vehicle,
- Moderate use of HOV lanes,
- Low use of transit services, and
- ITS investments are visible and growing, but not always mature, automated, or integrated.

Approximately 91.0% of Hampton Roads workers (over 16 years of age) travel to work by automobile, truck, or van; this rate is slightly higher than the comparable state and national

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<sup>8</sup> Virginia Department of Transportation, *VMT by Physical Jurisdictions — All Roads*, 2002.

<sup>9</sup> Federal Transit Administration, *2002 National Transit Database: Transportation District Commission of Hampton Roads (HRT)*.



rates of 89.8% and 87.9%, respectively. The proportion of Regional workers who carpool (12.1%) is nearly identical to the state (12.7%) and national (12.2%) experiences. However, the proportion of Hampton Roads workers that use public transportation (1.9%) is substantially lower than the state (3.6%) and national (4.7%) usage rates. Additionally, 68.9% of workers in the Region report a daily weekday commute time of 30 minutes or less, whereas only 4.9% of workers say their daily weekday commutes average 60 minutes or more. The latter figure compares favorably with the proportion of state (8.4%) and national (8.0%) workers reporting daily commutes in excess of 60 minutes.<sup>10</sup>

A recent study by the Texas Transportation Institute (TTI) measured the average length of the daily weekday “congested rush hour” in Hampton Roads at 5.6 hours (6:00AM-9:30AM and 3:30PM-7:00PM). TTI estimated the aggregate cost of rush hour congestion at \$396 million per year, equating to an annualized per capita cost of \$261. The TTI assessment further noted that congestion in the Region continues to worsen — that merely maintaining Regional congestion at its current levels would require the addition of approximately 42 new lane miles of roadways (freeway and arterial) per year.<sup>11</sup>

This latter observation is significant because, in these times of fiscal austerity, substantial new road-building every year, for many years into the future, is not practical or likely. Therefore, in addition to funding occasional, realistic road-building and capacity-expansion activities, new, creative methods for improving the operational and performance efficiencies of the existing roadway and transit infrastructures must be identified and implemented.

ITS, with its emphasis on projects that can be deployed reasonably fast and at moderate cost, continues to offer Hampton Roads an important part of the solution to the problem of worsening congestion.

## **1.4 ITS Planning in Hampton Roads**

Hampton Roads has been engaged in strategic ITS planning for the past decade. In 1995, the Region published its first long-range ITS plan, entitled *COMPARE: Congestion Management Plan — a Regional Effort*. The document presented a multi-modal, multi-agency approach to a coordinated ITS vision. It also included a Regional ITS Architecture, depicting the prospective interconnections among the Region's key ITS operators and stakeholders.

In 2000, Hampton Roads updated the 1995 document. The revision — *2000 COMPARE Update* — introduced needed modifications to the Region's long-range ITS plan, summarized Regional ITS deployments to date, and identified specific ITS projects for possible future deployment.

The current effort, *ITS Strategic Plan 2004*, signifies a full reworking of the long-range planning process to take account of (1) ITS experiences, activities, and projects actually

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<sup>10</sup> U.S. Census Bureau, *Census 2000*, Summary File 3.

<sup>11</sup> Texas Transportation Institute, Texas A&M University System, *Monitoring Urban Roadways in 2001: Examining Reliability and Mobility with Archived Data*, FHWA, 2003.

completed or underway; (2) major Region-wide challenges identified by ITS stakeholders; (3) planning and security issues associated with the experiences of 9/11; (4) a conscious desire by the Region to expand ITS activities related to incident and emergency management; (5) concurrent efforts to update the Region's long-range plans generally, notably its *2026 Plan*; and (6) tight fiscal conditions at the national, state, and local levels, necessitating that scant transportation dollars be expended wisely. Section 1.7 summarizes the methodology used to prepare the current ITS strategy.

As compared to other regions across the country, Hampton Roads has long been on the leading edge of ITS planning efforts. The Region pioneered development of an Early Deployment Plan, as presented in the 1995 report; the Region was also an early adoptee of an ITS Regional Architecture. The Region is presently engaged in significant ITS activities and projects. There is a strong partnership between VDOT and the Region, and a comfortable relationship among the Region's ITS stakeholders.

VDOT maintains a Smart Traffic Center (STC) in Hampton Roads and the major jurisdictions in the Region all have implemented — or have plans to implement — complementary municipal STC's. A series of projects to establish a Regional communications backbone and clearinghouse are underway, and the first major phase of freeway instrumentation has been completed. Additionally, such agencies as HRT and the Virginia State Police (VSP) are engaged in important ITS initiatives. More detailed information on existing ITS efforts is presented in Section 2.0.

## **1.5 Statewide Activities**

VDOT is engaged in a series of statewide ITS activities to support and augment the Regional efforts. Some of the most important statewide activities are summarized below:

Smart Travel Program: STC's in Hampton Roads, Richmond, and Northern Virginia monitor activities and conditions on instrumented freeways from a central operations control room.

Asset Management: A statewide Asset Management System is being developed to identify transportation assets and furnish status on their conditions.

511 Information Services: Virginia is planning a program to extend 511 traveler information services statewide.

Statewide Video-Sharing: VDOT plans to make video imagery from its STC's available to the general public through non-exclusive partnerships with the private sector.

Roadway Conditions Database: This statewide database, when completed, will be a clearinghouse for real-time and archived roadway conditions. The database will be used to feed real-time roadway conditions data into the statewide 511 system.

Critical Infrastructure Security: VDOT is implementing a statewide program to monitor bridges, tunnels, and other transportation assets vulnerable to man-made and natural disasters.

Archived Data Management System: The University of Virginia is in the process of developing a statewide archived data repository for the entire state of Virginia. The Hampton Roads STC, the Hampton Roads Planning District Commission, Hampton Roads Transit, and various cities in the Hampton Roads Region will interact with the management system.

Also, notably, VDOT has created a new senior staff position to direct innovative approaches to managing incidents and roadway assets, such as pavement and structures, as well as traveler information systems, snow and ice control, and work zone traffic controls.

## **1.6 National ITS Initiatives**

The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) exercise joint responsibility for national ITS activities. FHWA and FTA set national standards, furnish implementation guidance and assistance, and oversee deployment and research and development (R&D) efforts. Several of the more pertinent national initiatives are summarized below:

National ITS Architecture: A common framework for planning, defining, and integrating intelligent transportation systems.

National ITS Standards: Industry-consensus standards that define how system components operate within a consistent framework — i.e., the National ITS Architecture — to promote interoperability.

Intelligent Transportation Infrastructure Program: Use real-time traveler information to measure the operating performance of the roadway system in major metropolitan areas.

iFlorida Model Deployment: Using the experience in the Orlando metro area, create a national model that utilizes real-time information to enhance safety, security, and travel reliability.

Child Abduction Alert: Integrate the communications and response capability of transportation and public safety agencies to improve Child Abduction Alert and other emergency response capabilities.

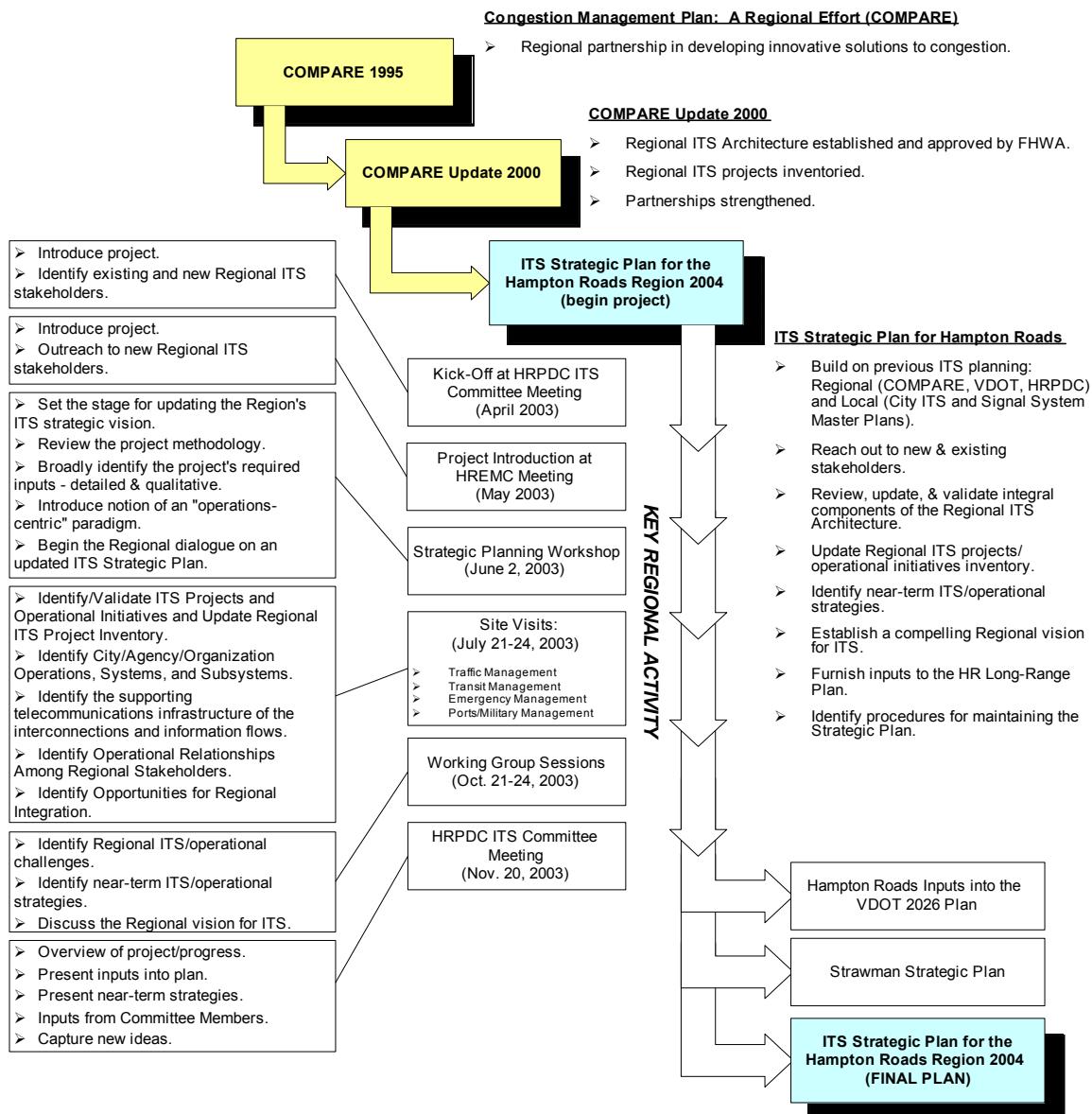
Intelligent Vehicle Initiative: Research into technologies (e.g., collision avoidance, electronic braking, and road departure avoidance systems) to help drivers avoid making hazardous mistakes.

Surface Transportation Weather Program: Research into the types of data and techniques for minimizing the impacts of adverse weather conditions on surface transportation.

Hazardous Materials Safety Program: Research into using technology to improve the safety and security of hazardous materials transportation.

## 1.7 Project Methodology

Figure 1.1, below, summarizes the process used to develop the 2004 Strategic Plan. The figure also shows that the current study builds logically on the prior — 1995 and 2000 — strategic planning efforts.



**Figure 1.1 2004 Strategic Plan Process**

Highlights of the major events in the 2004 Strategic Plan planning process are encapsulated below.

### **1.7.1 Strategic Planning Workshop**

A workshop was conducted, in June 2003, with members of the Hampton Roads ITS Committee and other selected ITS stakeholders. The session focused on (1) description of the Region's existing ITS infrastructure, (2) major transportation challenges and practical issues facing Hampton Roads, and (3) concurrence on a methodology for completing the strategic planning process.

### **1.7.2 Fact-Finding Site Visits**

During July 2003, fact-finding site visits were conducted with key ITS stakeholders across the Region. The sessions examined (1) operational and procedural activities, (2) identification of existing ITS assets, (3) identification of existing and planned ITS projects, and (4) major transportation challenges and issues facing the stakeholder and Region.

The following entities participated in the site visits: VDOT STC, Chesapeake Bay Bridge-Tunnel Commission, Hampton Roads Transit, Virginia State Police, Virginia Department of Emergency Management, Virginia Port Authority, Norfolk Naval Station, Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, Suffolk, and Virginia Beach. Other Regional organizations were contacted by telephone.

### **1.7.3 Working Group Sessions**

A series of working group sessions convened in Hampton Roads in October 2003. ITS stakeholders were invited to attend any or all sessions, although each session focused on a specific topic, as follows:

- Traffic Management — VDOT,
- Traffic Management — Local Jurisdictions,
- Transit Management,
- Commercial Vehicle Operations (CVO) Management,
- Emergency Management, and
- Ports/Military Management.

Participants in each session identified and discussed the transportation challenges facing the Region in relation to the specific topic area. They systematically examined and debated prospective ITS solutions to the different sets of challenges — both near-term and years into the future. Participants also addressed the interrelationships among the different topic areas.

### **1.7.4 ITS Committee Meeting**

The challenges identified by participants in the working group sessions were thoroughly documented and annotated. Subsequently, the challenges were organized by subject area and were found to group into six recurring "program" areas (see Section 3.0). Ultimately, ITS solutions that addressed the principal challenges within each of the program

areas were identified, and these challenges and solutions became the baseline for the *ITS Strategic Plan 2004*.

At a meeting of the Hampton Roads ITS Committee, in November 2003, the baseline plan was presented to Committee. On the basis of members' comments, both oral and written, the *ITS Strategic Plan 2004* was finalized. This report is a presentation of that plan.

Following the November 2003 ITS Committee meeting, inputs for the 2026 Regional Long-Range Transportation Plan were finalized and presented to the Transportation Technical Committee for the Hampton Roads Metropolitan Planning Organization (MPO). The Committee approved the inputs and they became part of the total 2026 Plan package approved by the Region's MPO on December 17, 2003.

## 2.0 EXISTING ITS FRAMEWORK

**T**his section defines the existing ITS Framework in the Hampton Roads Region. It offers an ITS “snapshot” of the Region as it existed at the time this Strategic Plan was developed. The section covers the following elements:

- An overview of roles of key agencies and jurisdictions,
- Status of programs and projects in VDOT, various cities, and other transportation-related organizations,
- The existing ITS Architecture for the Region from the *2000 COMPARE Update*, and
- An overview of the Regional communications infrastructure.

### 2.1 ***Overview of Key Agency/Jurisdiction Roles***

This section presents an overview of roles for key agencies and jurisdictions in the Region relative to surface transportation ITS, and operations and management.

#### 2.1.1 VDOT

##### VDOT Traffic Management System and the Hampton Roads Smart Traffic Center

The VDOT Traffic Management System (TMS) provides freeway surveillance, incident detection, traffic information dissemination, and a communications backbone. This system is controlled and monitored at the Hampton Roads STC. The STC includes management of traffic on 118 miles of freeway (I-64, I-264, and I-564) located in Virginia Beach, Chesapeake, Norfolk, Suffolk, Portsmouth, Newport News, and Hampton. The Smart Traffic Center communicates/coordinates with the following:

- The STC receives traffic data from, and provides it to, the following VDOT tunnel control centers:
  - Hampton Roads Bridge-Tunnel
  - Monitor Merrimac Memorial Bridge-Tunnel
  - Downtown Tunnel
  - Midtown Tunnel
- The STC shares incident data with the Chesapeake Bay Bridge-Tunnel.
- The STC communicates and coordinates with the Virginia State Police and local Emergency Medical Service (EMS) providers, especially during freeway incidents. Freeway Incident Response Team (FIRT) personnel also respond to incidents and assist in clearance.
- The STC communicates and coordinates with the several municipalities and shares traffic, traveler, and incident management data. Given the plans to connect the VDOT STC and municipal STC's, increased amounts of data will flow in the future.

- The STC communicates and coordinates with VDOT's statewide Transportation Emergency Operations Center via a dedicated communications network and will ultimately connect to the three other regional VDOT STC's located in other parts of the state.
- The STC communicates with the VDOT toll facilities at the Coleman Bridge.

#### VDOT Tunnel Traffic Control Systems

VDOT has traffic control and surveillance systems for the following tunnels:

- Hampton Roads Bridge-Tunnel
- Monitor-Merrimac Memorial Bridge-Tunnel
- Downtown Tunnel
- Midtown Tunnel

Each tunnel has its own system that provides traffic control, surveillance, incident detection, and traffic information dissemination. Each system also has a centralized traffic management center. As noted above, some data flows from the tunnel systems to the VDOT STC and vice-versa.

#### VDOT Freeway Incident Response Team

The Virginia Department of Transportation provides free roadside assistance on major highways in the Hampton Roads Region. In Hampton Roads, the safety service patrol is referred to as the Freeway Incident Response Team (FIRT). The Hampton Roads Bridge-Tunnel, the Elizabeth River Tunnel, and the Monitor-Merrimac Memorial Bridge-Tunnel also operate separate safety service patrol programs. FIRT works in conjunction with these bridge and tunnel safety service patrol providers.

### **2.1.2 Municipalities**

Municipalities perform traffic signal control, traffic signal preemption, signal coordination, arterial surveillance, traffic information dissemination, and communications. Municipalities currently communicate with their respective police, fire, and EMS departments.

The larger municipalities regularly communicate and coordinate with the VDOT STC. They plan on providing arterial traffic data to VDOT and, in turn, receiving freeway, tunnel or other data. Coordination at the intersection of freeways and principal arterials is important for traffic management, traveler information, and other purposes. The municipalities also work with VDOT to establish response plans for major incidents and regional disasters, such as hurricanes.

### **2.1.3 Transit Agencies**

Hampton Roads Transit and Williamsburg Area Transport provide transit services and are both exploring or pursuing ITS projects. HRT may have significant data to share once its automatic vehicle location (AVL) system comes on line. The transit operator is interested in

exploring additional opportunities for sharing data with other agencies and jurisdictions. HRT and Williamsburg Area Transit coordinate their services with each other in some locations; ITS systems might eventually be used to improve coordination.

### **2.1.4 Chesapeake Bay Bridge-Tunnel**

The Chesapeake Bay Bridge-Tunnel (CBBT) currently collects wind and roadway data from bridges comprising the facility. The CBBT shares incident information with VDOT and communicates with Virginia Beach's EMS for medical assistance during incidents. Additionally, CBBT relies on the Virginia State Police for incident response as back-up to its own police and fire crews.

### **2.1.5 Virginia State Police**

The Virginia State Police provides incident management and emergency response functions. It uses a computer-aided dispatch (CAD) system to improve dispatching efficiency and accuracy. VSP is in charge of incident response activities on state highways. It also communicates/coordinates with the VDOT Smart Traffic Center and local EMS providers during incidents. VSP maintains direct radio communication with the Smart Traffic Center.

### **2.1.6 Hampton Roads Planning District Commission**

HRPDC has been instrumental in uniting and organizing agencies in the area, which has facilitated the implementation of many regional ITS systems. HRPDC has also helped in mainstreaming ITS into the Region's traditional planning process. It collects system-related data that is used to pinpoint problems that can be corrected via ITS or other operations and management improvements.

## **2.2 Program and Project Status**

A brief description and current status of "key" programs and projects in the Hampton Roads Region is provided below. A more detailed Hampton Roads ITS Projects Inventory is provided in the *Appendix*. The Hampton Roads ITS Projects Inventory reflects both information provided by regional jurisdictions and agencies, as well as from information collected during outreach meetings with various agencies during the development of this document.

### **VDOT**

- Phases 1 and 2 of The Hampton Roads Traffic Management System, which performs freeway monitoring, traffic information dissemination, and provides a communications backbone, are operational. Phase 3 of the project is currently in progress.
- The *Regional Multimodal Management System (RMMS)*, an information-processing clearinghouse, is in the preliminary stages of development.

- A video- and data-sharing project that will enable sharing with jurisdictional STC's via a fiber backbone connection is currently under development. There is currently a fiber-optic link allowing video-sharing between the VDOT and Norfolk STC's.
- The Pinner's Point project involves building bridges over water to take traffic, especially trucks, out of the vicinity of the Port of Norfolk. The main emphasis of this project is to bring the roadway up to freeway level of service (LOS) and remove traffic from local streets. ITS will be an integral component of this project.
- VDOT has traffic control and monitoring systems in the regional tunnels and is currently upgrading those systems. The Hampton Roads Bridge-Tunnel, Monitor-Merrimac Memorial Bridge-Tunnel, and Midtown Tunnel are all working on integrating with the VDOT STC. The following data will be shared between the agencies: occupancy, speed, volume, CCTV footage, changeable message sign (CMS) status, and lane control status.
- Virginia is planning a program to extend 511 traveler information services statewide. The Hampton Roads Region will take part in this statewide effort.

### **Chesapeake**

- Chesapeake has completed the construction of an STC inside the City Hall building.
- Chesapeake is currently deploying an Advanced Traffic Management System (ATMS), scheduled for operation in 2004.
- Chesapeake is planning to expand the ATMS in the future with additional signals, cameras, and dynamic message signs.
- Chesapeake is planning for the expansion of toll facilities to handle seasonal volume increases. Some tolls are currently collected using electronic toll collection.

### **Hampton**

- Hampton's ATMS, consisting of centralized traffic signal control, traffic signal preemption/priority, arterial surveillance, and communications, is currently under construction.
- Hampton plans to build a STC and expand its ATMS.
- A city STC/VDOT STC communications connection is under development.

### **Newport News**

- Newport News has a centrally operated signal system that is currently deployed.
- Newport News plans to upgrade/replace signal controllers.

- A Newport News City Hall/VDOT STC communications connection is under development.
- An ITS Feasibility Plan and ITS Master Plan are in the planning stages.

## **Norfolk**

- Norfolk has deployed an ATMS that includes traffic signal control, arterial surveillance, incident detection, traffic information dissemination, and a communications backbone.
- Improvements and enhancements to the ATMS are planned for the future.
- A Norfolk ATMS/VDOT STC communications connection, which among activities allows for video sharing, is operational.
- Norfolk has planned an integration effort with the police, fire department, and EMS organizations.

## **Portsmouth**

- An ATMS is currently under construction. Expansion of the ATMS and a changeable message sign application is planned for the future.
- Phase 1 of the Portsmouth citywide computerized traffic signal project, which provides centralized traffic signal control, is operational. Phase 2 is planned and Phase 3 is a potential future project.

## **Suffolk**

- The City of Suffolk has deployed a centrally managed MultiSONIC signal system and plans to deploy additional signalized intersections.

## **Virginia Beach**

- Virginia Beach has completed an in-depth ITS Master Plan.
- The first phase of an ATMS is currently planned.
- Virginia Beach has future plans to share data and video with VDOT and neighboring cities.
- A citywide upgrade of traffic signal controllers and the STC are planned for the future.

## **Hampton Roads Transit**

- Hampton Roads Transit (HRT) has deployed an Advanced Scheduling System for fixed-route operations, including a comprehensive geographic information system for asset and route management.
- An Advanced Communications System (ACS), including a new radio infrastructure and CAD and AVL systems for fixed-route operations, is under procurement.
- HRT deployed a PeopleSoft Financial Management System as part of its Transit Information Enterprise System (TIES). The TIES framework links ITS systems with business and financial management to support HRT's strategic goals.
- Planning, research, and preliminary design are underway for a connection between HRT and the VDOT STC for near real-time video and data exchange in the future. Exchange of historical data is being field-tested in 2004 under the Archived Data Management System (ADMS) project with VDOT and the University of Virginia.

## **Williamsburg Area Transport**

- An incident management communications network providing Williamsburg Area Transport with incidents reports via e-mail is operational.
- AVL and traffic signal priority for transit vehicles are future possibilities.

## **Virginia State Police**

- VSP currently operates a CAD system.
- Mobile computer terminals and portable in-vehicle computer communication devices are under development for VSP vehicles.

In addition to the above, other jurisdictions and agencies also have existing or planned projects. For instance, the VDOT Hampton Roads District is upgrading traffic signal systems under its control, while York County is doing the same. CBBT is exploring approaches for improved travel over the Bay, and the Norfolk Naval Station is looking for ways to ease daily traffic into and out of the base. The Virginia Port Authority is considering traveler information systems for the truckers that leave the ports each day. In short, an extraordinary volume of ITS activity is ongoing, planned, or under consideration.

## **2.3 ITS Architecture**

In Hampton Roads, as in other metropolitan areas, several autonomous agencies work together to manage the roadway network; additional agencies are responsible for transit, enforcement, emergency services, broadcasting traveler information, and ports. Interaction and coordination between these agencies must exist to provide a seamless transportation network. ITS architectures serve as a framework for developing and implementing interaction and coordination between agencies.

The National ITS Architecture provides a common framework for planning, defining, and integrating ITS systems. The National Architecture is a mature product that reflects the contributions of a broad cross-section of the ITS community. The National Architecture is a template for Regional and other ITS architectures that defines:

- The functions (e.g., gather traffic information or request a route) that are required for ITS,
- The physical entities or subsystems where these functions reside (e.g., roadside or the vehicle), and
- The information and data flows that connect these functions and physical subsystems together into an integrated system.

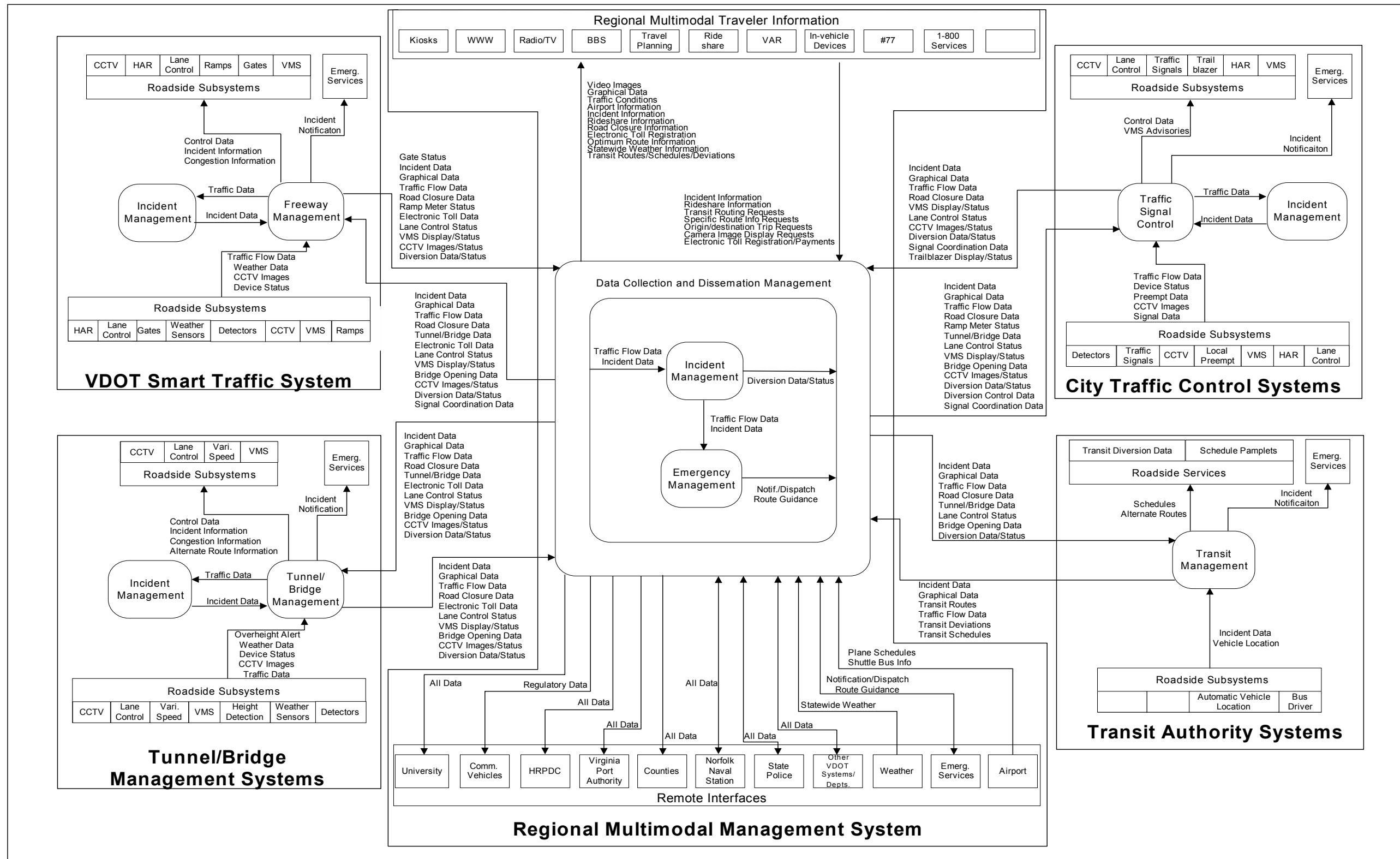
In short, all ITS architectures describe "what" a system does and "how" it does it.

Regional ITS architectures are tailored versions of the National ITS Architecture, including only the subsystems, interconnects, and information flows that are operating or are planned for that particular region, e.g., Hampton Roads. By defining an architecture specific to a region, regional architectures provide the planning basis for a seamless transportation system and foster communications among transportation agencies in a particular region.

Hampton Roads has gone through the process of developing and updating an ITS architecture for the Region. The process began with the development of the original *COMPARE* plan and was updated in the *2000 COMPARE Update*. The original architecture captured interconnects between the various transportation agencies in the Region, but did not provide detailed information flows. During the 2000 Update of the *COMPARE* plan, the architecture was revisited and restructured to include more detailed information flows between systems/organizations. The *2000 COMPARE Update* offers the most recent depiction of the Hampton Roads ITS architecture. This architecture, presented on the following page, was previously adopted by the Region.



## Hampton Roads Regional ITS Architecture (2000 View)





## **2.4 Communications**

Communication and coordination between agencies is the most critical piece of an integrated and seamless transportation system. Today, much of the communication of routine data between agencies is performed via telephone or fax. Most, if not all, of the regional agencies are working together towards the goal of communicating electronically via computer while maintaining some of the previous communications methods, where appropriate.

The Hampton Roads ITS network consists of many different elements: field components, such as changeable message signs, detector stations, Road Weather Information Systems (RWIS), and CCTV cameras; central equipment, such as computers, workstations, and monitors; and the human element. At the heart of center of these various elements is the VDOT communications backbone. The backbone will allow the different transportation agencies in the Region to link to VDOT as well as to each other. The backbone is currently being implemented in three phases:

- Phase 1 – 99 miles of fiber optic cables (19 roadway miles)
- Phase 2 – 149 miles of fiber optic cables (31 roadway miles)
- Phase 3 – 304 miles of fiber optic cables (63 roadway miles)

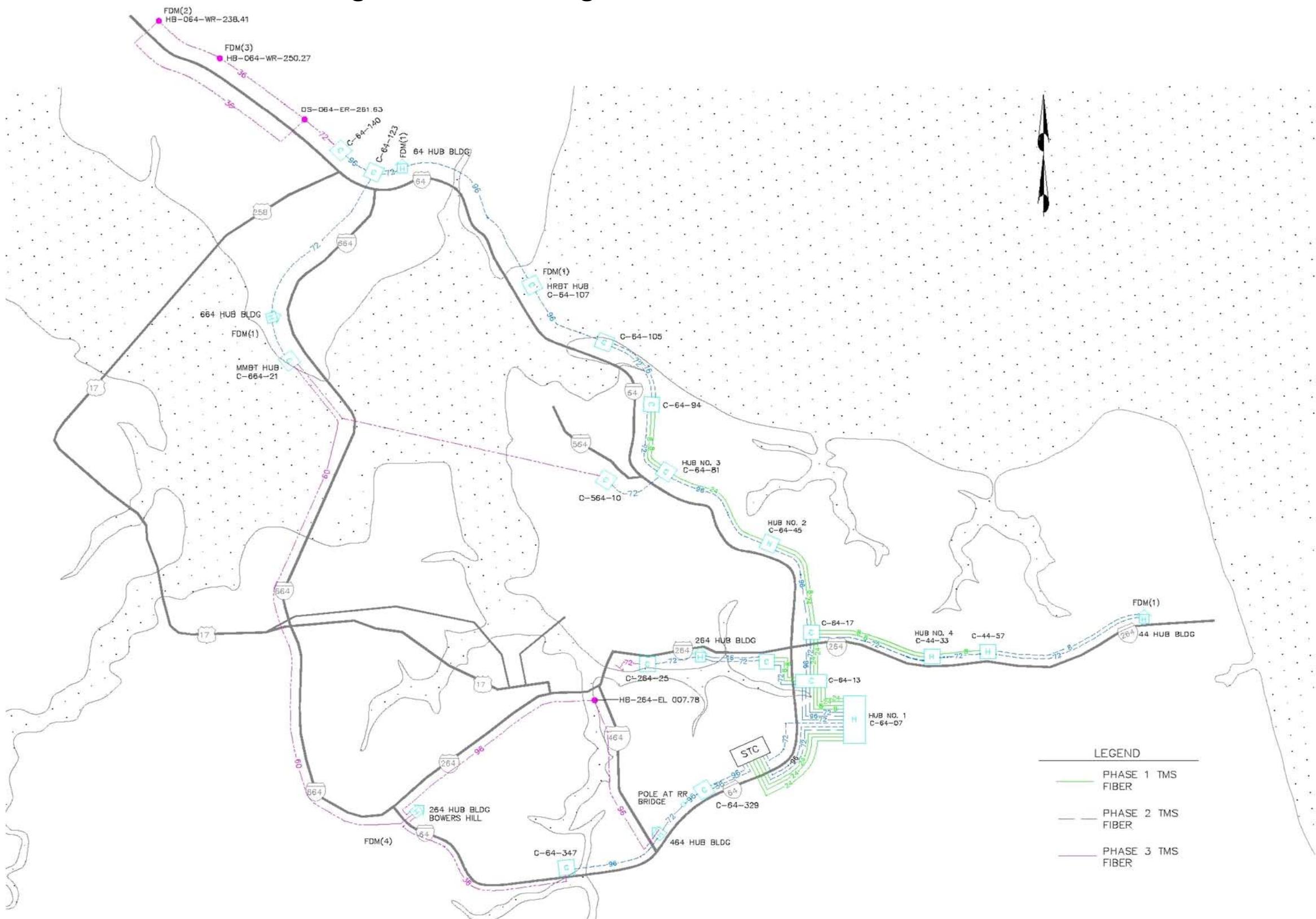
The VDOT backbone is depicted on the following page.

Plans are to eventually link all municipalities to the VDOT backbone. Currently, the City of Norfolk's ATMS is connected to the VDOT STC via the backbone and video communications began in 2002; additional localities expect to connect shortly. Similarly, HRT is evaluating video communications and data-sharing with the VDOT STC. While communications occur between jurisdictions and agencies in the Region in several ways, the VDOT backbone is expected to function as a common, centralizing element.

Given its importance, the VDOT backbone must be capable of providing sufficient, high-speed capacity as the amount of data flows increase. Moreover, its central role dictates that it be a secure and redundant system with little likelihood of a catastrophic failure.



## Existing and Planned Regional ITS Communications Backbone





## 3.0 ITS STRATEGIC PROGRAM AREAS

**A**n exhaustive assessment of inputs furnished by Hampton Roads stakeholders led to the identification of six ITS strategic program areas. Virtually all of the Regional transportation-related “challenges” cited by strategic planning participants — see Section 4.0 — addressed topics related to one or more of the six program areas. These program areas, consequently, became an essential focal point of the strategic planning process. They served as an important organizing principle for determining which projects and solutions should be included in the final plan.

The six program areas are identified and defined below:

**Systems Integration** — Upgrading communications for data and voice systems, both automated and real-time, to maximize management and responsiveness.

**Incident and Emergency Management** — Improving detection, management, and information dissemination for traffic incidents and other emergencies.

**Transportation Management** — Improving the control and operation of freeways, arterials, and bridge/tunnels on an integrated, inter-jurisdictional, and traffic-responsive basis.

**Systems Management** — Installing components to monitor and detect the status of traffic, physical roadway systems, and vehicle operational systems.

**Traveler Information** — Deploying systems to provide timely and decision-critical travel information to travelers planning trips and en-route.

**Program Development and Management** — Developing support for effectively reaching consensus on ITS policy, deploying cost-effective and standardized systems, monitoring and maintaining system performance, and institutionalizing good practices.

The six program areas are not independent of each other. For example, Transportation Management and Traveler Information both depend on improved Systems Integration and Systems Management. Because of these complex interrelationships, activities within most of the program areas will need to be implemented concurrently.



## 4.0 SUMMARY OF REGIONAL CHALLENGES

**C**hallenges exist that impede the development of a fully integrated and seamless transportation system in the Hampton Roads Region. Despite its national leadership in the ITS arena, the Region has encountered — as have many other regions — a range of significant problems, including the following:

- Procurement and contractor difficulties,
- Delayed and flawed project deployments,
- Resource reductions, such as those for the Freeway Incident Response Team,
- Failures in deploying traveler information systems,
- Lack of trained staff to address sophisticated systems issues,
- Lack of champions at the senior policy level, and
- Inadequate coordination between certain organizations.

Some of these challenges are technical in nature and some are institutional. Moreover, solutions to some of these challenges will involve more than just the transportation sector alone. Section 7.0, which focuses on *Implementation Strategies*, will discuss prospective approaches to meeting these challenges.

The following subsections describe challenges associated with each program area defined in Section 3.0. Most, if not all, of these challenges were enunciated in the six working group sessions, held in October 2003, as part of this Plan's development. A more detailed list of challenges is provided in the *Appendix* of this document. While the challenges are many, the Region has a solid base on which to build. This Plan contemplates a long-term approach to meeting these challenges, which are similar to those other regions also face.

### 4.1 **Systems Integration**

The Hampton Roads Region needs to seamlessly transfer critical transportation data/information between agencies and jurisdictions to enable better operations and management of its transportation network. In order for data/information to be transferred in a seamless fashion, the following challenges should be addressed:

- Clearly define the roles and responsibilities of regional jurisdictions and agencies and the relationship of systems as part of achieving an integrated transportation environment.
- Address the technological challenges of integrating systems and achieving interoperability.
- Complete a communications backbone supporting the exchange of information between agencies.
- Integrate the VDOT Smart Traffic Center with other VDOT or local systems to enhance the flow of traffic information throughout the Region.

- Utilize standards, protocols, and agreements to support the integration of the various systems/organizations.
- Better educate several stakeholders in the Region who lack an understanding of the utility of ITS in the Region and the importance of system integration.

## **4.2 Incident and Emergency Management**

Effective incident and emergency management is critical to the efficiency and safety of the transportation system in the Hampton Roads Region. Some of the challenges associated with meeting the objective of a solidly performing incident and emergency management system include:

- Clarify the roles, responsibilities, and coordination mechanisms for an integrated incident and emergency management system.
- Update and refine the current strategy and plans for managing large-scale evacuations in the Region with involvement by VDOT, the cities, HRT, emergency management agencies and others.
- Improve incident detection efforts so they are faster and more reliable, and contribute to better overall management of incidents.
- Increase the availability of reliable weather information, especially for hurricanes and storms resulting in floods, and ensure the information is shared among agencies in the Region.
- Develop enhanced methods of disseminating accurate emergency and incident information to the public in a timely manner.
- Integrate communications and information exchange between incident and emergency management agencies for a seamless response to incident and emergencies.

## **4.3 Transportation Management**

In order to achieve optimal performance in the Hampton Roads Region, the transportation management system must be able to solve the following challenges:

- Reduce or eliminate chronic back-ups at key facilities such as the Hampton Roads Bridge-Tunnel and Downtown Tunnel.
- Improve detection capabilities on major interstates and principal arterials.
- Replace several outdated traffic signal systems that lack central control with updated systems.

- Improve work zone planning, coordination with other affected agencies and jurisdictions, as well as travelers, and use improved work zone configurations.
- Increase coordination between and within agencies on the status of road, bridge (i.e., raisings), and tunnel and transit conditions.
- Expand coordination between agencies during special events, such as when Naval ships return from deployment and the planned 2007 Jamestown celebration.

## **4.4 Systems Management**

In order to successfully manage systems, the Region must be able to meet the following challenges:

- Secure critical assets from terrorist acts and natural disasters.
- Protect against occasional failures of critical support, such as electrical power and phone services, during emergencies in the Region.
- Add backup and/or redundant facilities and/or systems for emergencies, such as hurricanes and other natural disasters.
- Build out a fully interoperable communications infrastructure in the Region.
- Update existing and obsolescent transportation systems.
- Develop a “central” data repository or clearinghouse supporting data/info exchange in the Region.
- Expand real-time operational coordination between transportation and non-transportation stakeholders (i.e., ports, military bases, and emergency management agencies).

## **4.5 Traveler Information**

There are several challenges involved in the Hampton Roads Region for providing travelers with reliable and timely traveler information. These challenges include:

- Improve supply of quality data to be used for reliable traveler information.
- Expand modes for disseminating reliable and real-time traveler information to highway and transit users.
- Tailor appropriate traveler information to tourists, ports, and the military, which are responsible for a majority of the travelers in the Region.
- Use predictive tools to enable reliable projections of travel times.

- Define the role of the public versus the private sector in furnishing traveler information in the Region.
- Develop traveler information systems to fulfill the needs of users that provide (1) congestion and incident alerts, (2) reasonable alternate route information, (3) estimated travel times, and (4) information that is adaptable to time of day/week/month/year and type of traveler.

## **4.6 Program Development and Management**

The Region's ITS program is ever evolving and needs to be managed accordingly. Challenges involved with effectively managing the Hampton Roads ITS program include:

- Educate policy makers, broader transportation and public works staffs, and other non-transportation groups on the value of ITS and enhancing management and operations of the surface transportation system.
- Increase the number of Champions at the policymaker level and from outside the immediate transportation community.
- Staff the increasingly complex transportation systems in the Region with more skilled technicians.
- Achieve more "standardization" between agencies to support data exchange and possible economies-of-scale through joint equipment procurements.
- Improve state and local procurement and deployment procedures.
- Refine and adopt methods to ease transitions to new systems and technologies, including the management of system configurations.
- Expand operational coordination and sharing of resources between jurisdictions and agencies.
- Eliminate roadblocks to funding, planning, and deploying projects in the Region.

## 5.0 ITS STRATEGIC VISION

The Hampton Roads Region already operates a robust ITS program that focuses on improved freeway and arterial management. There now exists the need and desire to expand the scope and magnitude of the ITS program. Towards this end, a strategic plan has been established to support the expanded effort. Specifically, the ITS strategic plan is designed to:

- Maintain the implementation momentum by completing the current projects and extending their coverage throughout the Region.
- Move from disparate ITS projects towards an integrated Regional program.
- Identify immediate action priorities prompted by the higher level of Regional consciousness and concern about emergencies, including both security- and disaster-related emergencies.
- Leverage the on going ITS and capacity project investments with a focus on defining the operational strategies and protocols, negotiating the needed inter-jurisdictional agreements, obtaining the necessary staff and capital resources, etc.
- Shift the Regional transportation focus to an “operational” paradigm.
- Identify and implement the logical next steps in ITS implementation, building on the existing investments and experiences to ensure cost-effective improvements.
- Define affordable, doable next steps, consistent with reasonable expectations regarding level of investment and staff support.
- Coordinate the implementation of interdependent ITS projects and activities.
- Improve services, responsiveness, and accountability to customers.

The focal point of the strategic plan is on six program areas, identified during extensive dialogue with the Region's ITS stakeholders. As noted previously, the six program areas are:

- Systems Integration,
- Incident and Emergency Management,
- Transportation Management,
- Systems Management,
- Traveler Information, and
- Program Development and Management.

The planning horizon for this ITS Strategic Plan is 22 years into the future, through the year 2026, consistent with the Region's long-range transportation planning process.

The plan specifies three implementation time intervals for the period 2004-2026. The three time intervals are:

- *Near-Term: 2004-2009.* This time period is based principally on completing current committed projects and activities in each of the six program areas — i.e., building out the “core” ITS infrastructure — and initiating logical, follow-on activities.
- *Mid-Term: 2010-2017.* During this time interval, each program area will be permitted to mature. Enhanced systemic, information sharing, and information-exchange features will be introduced.
- *Long-Term: 2018-2026.* In this time period, advanced features will be implemented; the focus will be on systems integration and data fusion. It should be noted that details of the efforts over the long-term cannot be specified with certainty, as Regional needs and conditions will continue to change and new, real-world technologies will become available.

Each of the six program areas, presented here, contain one or more ITS solutions, or milestones, across each of the three timeframes. For a given program area, the milestones signify a logical progression towards a common program vision. The milestones are intended to address the major transportation challenges identified by Regional stakeholders.

This section of the Strategic Plan examines each program area. It (1) identifies an ITS “vision” for 2026, (2) discusses key issues associated with the program area, (3) describes a general implementation strategy, (4) identifies and details prospective projects for the three time intervals, (5) specifies major prerequisite activities to be completed before new projects are undertaken, (6) summarizes important transportation benefits likely to be realized as implementation progresses, and (7) estimates costs to implement the projects. Note that costs shown are in 2004 dollars and are exclusive of operations and maintenance (O&M) costs.

The section begins with identification of potential “rapid-term” solutions that could be implemented relatively fast and offer probable “quick-turn-around” benefits for the Region. These solutions are drawn from all six program areas.

## **5.1 Rapid-Term Solutions: 2004-2005**

During the outreach portion of developing this Strategic Plan, a number of challenges and potential solutions were identified and discussed. Some of these solutions could be implemented very quickly — in 6 to 18 months — and offer potentially fast payoffs, i.e., tangible transportation benefits, for the Region.

The key rapid-term challenges and potential solutions are described below:

### **Challenge: Over-Height Trucks**

Hundreds of over-height trucks are turned around just before entering the Region's tunnels, especially the Hampton Roads Bridge-Tunnel (HRBT), which delays traffic during the pullover and turn-around.

Potential Solutions:

1. Gather data to determine whether particular trucks or trucking companies are causing most of the delay. If a specific subset of truckers is disproportionately responsible, work directly with the truck owners/drivers to reduce and/or eliminate the over-height problem.
2. Place detection systems at earlier points in advance of the tunnels, enabling truck drivers to use alternate routes. Consider placing detection systems on arterials that feed onto I-64 near the HRBT.
3. Determine earlier convenient locations for stopping and turning around trucks so as to minimize traffic delays.

### **Challenge: Special Events and Bridge Raisings Notification**

Special events, e.g., aircraft carrier arrivals, and bridge raisings cause traffic delays. Advance notification to the potentially affected jurisdictions and agencies would enable proactive steps to minimize traffic delays.

Potential Solutions:

1. Assign a coordinator, or coordinators, to track special events and bridge raisings, and to publicize this information and notify relevant jurisdictions and agencies on a timely basis. Locations for a coordinator(s) might be VDOT or HRPDC.
2. Determine whether any aspect of the Roadway Information System can be used to collect and provide this information or whether there are other existing tools that might be used to collect and transfer this information.

### **Challenge: Unexpected Work Zone Setups and Configurations**

At times, work zones are set up on the freeways without prior consultation with neighboring jurisdictions, whose arterials and other roads are often affected.

Potential Solutions:

1. VDOT should develop clear processes and procedures for working with the local jurisdictions in the configuration and establishment of work zones.

### **Challenge: Ambiguity Over Emergency Response Roles**

In Hurricane Isabel and other emergencies, jurisdictions and agencies (specifically noted in the Transit Management Working Group Session) were not clear on their transportation roles in emergency and incident response.

Potential Solutions:

1. Through an appropriate Regional forum or outside support, develop a high-level Regional concept of operations that assigns roles and responsibilities to the several involved agencies. Aim for a broad, high-level concept initially; then, over a longer period of time, further refine the concept of operations and add appropriate agreements between jurisdictions and agencies.
2. Consider Homeland Security funding for development of the concept of operations.

### **Challenge: Coordination of Transportation and Emergency Management and Response Agencies During Emergencies**

During Hurricane Isabel and other emergencies, coordination procedures have proven to be inadequate.

Potential Solutions:

1. Develop procedures and capabilities to hold regular Regional conference calls during emergencies.
2. Include major transportation stakeholders including HRT.
3. Exercise the Regional conference call procedures regularly.

### **Challenge: Identifying and Contacting Responsible Transportation and Emergency Management/Response Personnel in Emergencies**

During Hurricane Isabel and other emergencies, quickly identifying and reaching appropriate response personnel at transportation and other agencies has been difficult.

Potential Solutions:

1. Develop a Regional emergency point-of-contact (POC) list with key personnel and contact information, as well as backup POC's in the event the primary POC's are not available.
2. Develop a process for maintenance and distribution of the POC list.

### **Challenge: Ability to Quickly Clear Incidents on Freeways**

The reduction in FIRT staff has decreased the ability to quickly clear freeway incidents, which causes a high proportion of the delays in the Hampton Roads Region.

Potential Solutions:

1. Restore budget and staffing for FIRT.
2. Reevaluate FIRT deployment and usage to ensure FIRT is most effectively utilized, given other evaluation work being done in other parts of Virginia and nationally.

### **Challenge: Coordination Between VDOT STC and Bridge/Tunnel Control Centers**

Comments made at the working group sessions for this Plan indicated data and information exchange between the VDOT STC and the VDOT bridge/tunnel control centers is not optimal.

Potential Solutions:

1. VDOT STC and bridge/tunnel control center management need to develop methods for better exchange of data and information. If necessary, higher-level district or central office managers should be involved.
2. To the extent required, written agreements or procedures may be developed to support revised methods of exchanging data and information.

### **Challenge: Transit Bus Information**

Bus schedules and other transit information are typically not posted at bus stops.

Potential Solutions:

1. Identify a feasible means for posting static bus schedule information at bus stops; then post the information.
2. Begin to plan for more sophisticated means of posting bus schedule and other transit information at bus stops, including consideration of eventually displaying real-time bus arrival information based on AVL data.

## ***5.2 Systems Integration***

The focal point of the Systems Integration program area will be a *Regional Multimodal Management System*, which will serve as the central data repository and information-exchange gateway for Regional ITS activities. Three sets of projects are planned in this program area, as follows:

- Establish RMMS,
- Implement Advanced RMMS Integration, and
- Implement Analytic and Predictive RMMS Modeling.

The RMMS, as a concept, was previously envisioned by VDOT and the Hampton Roads ITS Committee. The ideas presented here, however, significantly expand the scope and functionality of the RMMS as it was formerly conceptualized.

## **5.2.1 Vision**

In 2026, current real-time roadway conditions across Hampton Roads are instantaneously accessible to transportation agencies, law enforcement personnel, emergency managers and responders, media, and other stakeholders, including the general public. Incident alerts are automatically communicated to cognizant stakeholders. Information-exchange and communications among jurisdictions and agencies occur seamlessly and transparently; access rights to privileged data are carefully safeguarded. Data fusion, predictive modeling, the extensive use of performance measures, and other sophisticated analytic techniques assist transportation managers in effective decision-making and optimization of the Regional transportation infrastructure.

## **5.2.2 Discussion**

Several recurrent themes were identified by participants in the strategic planning process: (1) there is a dearth of institutional mechanisms for coordination, communications and dialogue, and information exchange and sharing among Regional jurisdictions and agencies; (2) key systems and databases across the Region have not been integrated; and (3) accessing required information in a timely manner is often difficult or impossible.

The RMMS, as defined here, is intended to address these and other related deficiencies. The goal is to implement a powerful, robust system that supports the information-exchange and communications requirements of the Region; and to streamline the collection, storage, and exchange of data using a central repository. The emphasis will be on verified, accurate, and timely information, and also on predictive and analytic modeling capable of improving operations, mitigating adverse conditions, and issuing advice to travelers. Here the goal will be instantaneous assessment of delay conditions and the real-time formulation and execution of a suitable mitigation plan. Properly implemented, the RMMS will constitute the systemic and communications “backbone” of the Region’s ITS infrastructure. Most other initiatives presented in this Strategic Plan will necessarily be erected on the “shoulders” of the RMMS. The other initiatives will, in turn, strengthen the utility and performance of the RMMS.

Although the RMMS, at its core, signifies technology, it presupposes important progress by the Region on a host of non-technology and institutional fronts. These include a willingness among stakeholders to engage in information-exchange; the implementation of procedures for capturing needed data; adoption and adherence to new data standards, etc.; and creative thinking about the utility of available data to improve operations and to predict and mitigate adverse conditions.

### **5.2.3 Strategy**

The RMMS is the successor to the Roadway Information System (RIS) and is in the early stages of implementation. The RMMS builds on RIS lessons learned and Regional ITS investments that are enhancing automation, communications, data collection, data transmission, systems integration, and dissemination of traveler information. In its early stages, the RMMS will integrate data from the jurisdictional STC's, as each local STC links to the VDOT communications backbone fiber infrastructure of the VDOT STC. This incremental integration will enable the RMMS to provide immediate and near-term escalating benefits, including enhanced Regional operations and improved coordination during traffic incidents.

Expanded builds to the RMMS during the mid- and long-term periods will encompass integration of other Regional transportation management systems, including CAD systems for enhanced traffic incident detection; advanced communications between the VDOT STC and other operations centers; predictive and adaptive algorithms to convert data from multiple sources into useful information for management and advisory purposes; and an automated platform for public transportation fleet and asset management.

### **5.2.4 Phased-Implementation Approach**

Key recommended solutions, by time period and project details, are summarized below:

#### **Near-Term Period (2004-2009)**

##### ***Project 1: Establish RMMS***

- *Operational Description:*
  - Implement RMMS physical and communications infrastructure
  - RMMS functions: data capture, data processing and storage, data-exchange, and data-dissemination
  - Integrate RMMS with existing roadway and transit systems
  - Implement RMMS data stream to and from jurisdictions
- *Key Systemic Components:*
  - Hardware platforms
  - RMMS software
  - Communications system
  - Interface protocols
  - Analysis tools and report-generators
- *Development Approach:*
  - Examine the RIS experience for lessons learned
  - Conduct detailed functional requirements assessment
  - Analyze interface requirements
  - Detail the architecture for the RMMS and define a concept of operations
  - Spec hardware, software, and communications
  - Design systems by module

- Develop and test modules
- Test links to existing infrastructure — VDOT, jurisdictions, agencies (e.g., HRT, VSP, Virginia Department of Emergency Management (VDEM), Virginia Port Authority (VPA)), etc.
- Integrate new specialized applications (e.g., 511) with RMMS
- Deploy RMMS I

### **Mid-Term Period (2010-2017)**

#### ***Project 2: Implement Advanced RMMS Integration***

- *Operational Description:*
  - Enhance RMMS physical and communications infrastructure, as warranted
  - Expand data streams to and from jurisdictions and agencies
  - Expand integration with specialized applications to include incident management, advanced traveler information, etc.
  - Optimize the timeliness and reliability of RMMS data
  - Improve the dissemination of RMMS data
- *Key Systemic Components:*
  - Hardware platforms
  - RMMS software
  - Communications system
  - Interface protocols
  - Analysis tools and report-generators
- *Development Approach:*
  - Expand system capacity
  - Examine availability of data and commonality of requirements across jurisdictions
  - Implement new modules/expand existing modules to address growing Regional data requirements
  - Design/develop links between the RMMS and key Regional applications — e.g., CAD/TMC, ATIS, etc.
  - Optimize system
  - Define new, innovative uses for available data — both for operational purposes and public consumption; disseminate data
  - Develop data interface and analysis tools
  - Deploy RMMS II

### **Long-Term Period (2018-2026)**

#### ***Project 3: Implement Analytic and Predictive RMMS Modeling***

- *Operational Description:*
  - Enhance RMMS physical and communications infrastructure, as warranted
  - Expand RMMS integration

- Introduce data-fusion technology and techniques into RMMS<sup>12</sup>
- Expand analytic capabilities of RMMS
- Improve the dissemination of RMMS data
- *Key Systemic Components:*
  - Hardware platforms
  - RMMS software
  - Communications system
  - Interface protocols
  - Data-fusion algorithms
  - Advanced analysis tools and report-generators
- *Development Approach:*
  - Expand system capacity
  - Identify, study, and assess data-fusion techniques and other candidate technologies for incorporation into RMMS
  - Design/develop algorithms and models using the most promising technologies
  - Implement algorithms and models, test, and optimize performance
  - Implement new analytic and report-generation capabilities
  - Deploy RMMS III

## 5.2.5 Prerequisites

The milestones associated with this program area are predicated on the following:

- Completion of the VDOT infrastructure and communications backbone.
- Establishment of local STC's and deployment of centrally controlled traffic signal systems.
- Linkage of local STC's to the VDOT backbone.
- Ongoing implementation of projects to improve the detection and monitoring of roadway conditions.

## 5.2.6 Summary of Benefits

Key Regional benefits expected as a consequence of these Systems Integration activities include:

- *Improved operations*, as reliance on ad hoc, non-automated information exchange is reduced.

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<sup>12</sup> Data-fusion technology integrates, or melds, data from multiple sensors, databases, and other sources to achieve improved accuracies and stronger, more robust inferences about the environment. Though still in its infancy, data-fusion offers the possibility of improved, real-time prediction of outcomes and real-time decision-making. Data-fusion might, for example, be used to predict the time required to return traffic conditions to normal after clean up of an incident by taking into account a variety of complex factors and conditions.

- *Enhanced mobility and customer satisfaction*, as the currency and reliability of roadway status information improves, particularly in relation to traffic incidents and predicted conditions.
- *Enhanced safety and security*, as the timeliness and reliability of information exchange among first responders and transportation system operators improves.

### **5.2.7 Estimated Development Costs**

Preliminary costs for deploying the RMMS during the three principal time periods are estimated as follows:

<b>Near-Term Period</b>	<b>RMMS I</b>	<b>\$2,250,000</b>
<b>Mid-Term Period</b>	<b>RMMS II</b>	<b>4,500,000</b>
<b>Long-Term Period</b>	<b>RMMS III</b>	<b><u>4,000,000</u></b>
<b>TOTAL ESTIMATED COST</b>		<b>\$10,750,000</b>

These costs pertain to the RMMS components only. They are exclusive of the costs for hardware and software within the municipalities, on the roadside, etc. They also do not reflect the expense of installing communications cable across the Region.

### **5.3 Incident and Emergency Management**

In the program area of Incident and Emergency Management, the focus will be on expanding the Regional infrastructure to support more efficient detection of — and response to — emergency incidents and events that potentially impact the transportation system. These range from localized roadway incidents to multi-jurisdictional or Region-wide events, and could include crashes, vehicle breakdowns, hazardous materials spills, storms and other natural disasters, and man-made incidents. Some categories of emergencies could require the evacuation of large numbers of people, which would impose additional demands on the transportation system.

Five sets of projects are envisioned in this program area. They are:

- Define Incident Management/Emergency Management (IM/EM) Procedures,
- Implement CAD Integration I: State CAD/State STC Integration,
- Implement CAD Integration II: Local CAD/Local STC Integration,
- Develop Real-Time Messaging for Responders, and
- Implement CAD Integration III: Full RMMS Integration.

This program area emphasizes both institutional and technology enhancements. The former pertain to the interrelationships among the stakeholders involved in incident and emergency management, and the operational procedures they employ. The latter refer to technologies for improving event detection and responsiveness.

### **5.3.1 Vision**

In 2026, surface transportation managers are prepared for major emergencies — natural or man-made — through the availability of systems and operational procedures that protect and secure critical transportation infrastructure, enable the rapid movement of sizable populations out of the Region when necessary, and permit the delivery of relief workers and supplies. Surface transportation managers are also fully prepared with systems and operational procedures for handling day-to-day incidents on the transportation grid that enable quick-response and quick-clearance. Effective coordination and data-exchange between transportation officials and emergency managers and responders are routine.

### **5.3.2 Discussion**

Strategic planning participants identified a need for improved coordination mechanisms in this program area, including clarity in roles and responsibilities when incidents and emergencies occur. Additionally, all of the following are needed: (1) faster, more reliable incident detection; (2) the ability to respond more rapidly to emergencies; (3) improved ability to assess conditions and impacts; (4) enhanced decision-making with regard to suitable options and responses; and (5) sharpened capability to communicate incident and emergency management information to the general public.

Important backdrops to these discussions about incident and emergency management were the 9/11 and Hurricane Isabel experiences in 2001 and 2003, respectively. Both reminded participants of the central role of the transportation system in responding effectively during major emergencies. In fact, the Hampton Roads Region faces numerous challenges because of the presence of military bases and ports, the occurrence of significant weather-related events, and the need to prepare for evacuations over a roadway system constrained by waterways. Participants identified the capability to efficiently manage large-scale evacuations as a critical Regional need.

A continuum exists between responses to small-scale incidents and large-scale emergencies. Steps taken for improved responses at one end of the continuum will often contribute to improvements at the other end.

The solutions proposed in this program area are essentially two-fold: (1) fine-tune the institutional mechanisms across the Region for coordination and communications during emergencies; and (2) deploy suitable technologies to assist in the detection, monitoring, and assessment of events and to communicate information effectively about those events to operational stakeholders and the public. The latter takes the form of CAD/transportation systems integration, to be implemented in three stages. It also includes real-time messaging to responders.

### **5.3.3 Strategy**

Upgrading incident and emergency management depends on improvements at each stage in the IM/EM process: preparation, detection, response, management, and clearance. These improvements involve incremental reductions in total clearance time and,

concurrently, expansion in the ability to respond to a wider range of incidents with appropriate tools and protocols. The first stage focuses on integrating CAD and transportation systems at the state level; the second on integrating CAD and transportation systems at the local level. The third stage emphasizes full access to state and local data using the RMMS. During virtually all of the projects, a multi-stakeholder approach involving VDOT, local jurisdictions, transit agencies, law enforcement, emergency and medical personnel, and private tow operations is essential.

### **5.3.4 Phased-Implementation Approach**

Key recommended solutions, by time period and project details, are summarized below:

#### **Near-Term Period (2004-2009)**

##### ***Project 1: Define Incident Management/Emergency Management (IM/EM) Procedures and Concept of Operations (CONOPS)***

- *Operational Description:*
  - Defines roles and responsibilities for Regional IM/EM
  - Identifies the interrelationships among IM/EM stakeholders
  - Establishes performance-based measurement goals
- *Key Systemic Components:*
  - None
- *Development Approach:*
  - Define the operational roles of VSP and municipal police agencies, emergency managers, transit, VDOT, VDEM, U.S. Department of Homeland Security, military bases, ports, etc.
  - Upgrade on-scene incident management procedures, including quick clearance, hazmat procedures, and data-gathering technologies
  - Identify critical corridors/intersections for incident diversions and evacuations
  - Identify requirements and entities responsible for specific IM/EM activities
  - Determine responsibilities for freeway/arterial traffic diversions and coordination requirements
  - Determine responsibilities and procedures for monitoring and mitigating conditions during route diversions/evacuations
  - Identify procedures used to disseminate emergency information to the public
  - Identify the critical transportation assets in the Region and determine what roles ITS/operations could play in enhancing security of those assets
  - Prepare a “strawman” CONOPS and validate with Regional stakeholders

##### ***Project 2: Implement CAD Integration I: State CAD/State STC Integration***

- *Operational Description:*
  - Integrates VSP CAD and VDOT STC for more rapid detection of incidents
  - Limited data are available to the Region via the RMMS

- *Key Systemic Components:*
  - Hardware enhancements: VSP, VDOT
  - Software enhancements: VSP, VDOT
  - Interface & communications system
  - RMMS enhancements
- *Development Approach:*
  - Conduct detailed functional requirements analysis
  - Spec hardware, software, & communications
  - Engineer systems design
  - Develop & test functions
  - Integrate data feeds
  - Deploy CAD/STC Integration

### **Mid-Term Period (2010-2017)**

#### ***Project 3: Implement CAD Integration II: Local CAD/Local STC Integration***

- *Operational Description:*
  - Integrates municipal police CAD with local STC's
  - Limited data are available to the Region via the RMMS
- *Key Systemic Components:*
  - Hardware enhancements: Local police, highway, and transit agencies
  - Software enhancements: Local police, transportation, and transit agencies
  - Interface and communications system
  - RMMS enhancements
- *Development Approach:*
  - Conduct detailed functional requirements analysis
  - Spec hardware, software, & communications
  - Engineer systems design
  - Develop and test functions
  - Integrate data feeds — integration plans will vary by locality
  - Deploy CAD/Local STC Integration

#### ***Project 4: Real-Time Messaging Service for Responders***

- *Operational Description:*
  - Enables real-time data messaging between responders during incidents and emergencies
  - Allows the real-time creation of message groups, comprised of responders involved in common incident or emergency cases
- *Key Systemic Components:*
  - Desktop/in-vehicle devices and personal digital assistants (PDA's)
  - Data access server
  - Message gateway

- Message switch
- *Development Approach:*
  - Prepare architecture & concept of operations
  - Develop institutional agreements
  - Establish message “center”
  - Plan and perform integration

### **Long-Term Period (2018-2026)**

#### ***Project 5: Implement CAD Integration III: Full RMMS Integration***

- *Operational Description:*
  - Completes integration of CAD/State STC-Local STC data with RMMS
  - Stakeholders now have unencumbered access to real-time, integrated incident and emergency data for the entire Region
  - RMMS data are fused with other systems, such as ATIS
- *Key Systemic Components:*
  - Hardware & Software enhancements: VSP, STC, local police, local STC, RMMS
  - Interface development
  - Enhanced communications
  - Analysis tools and report-generators
- *Development Approach:*
  - Execute Regional CAD integration
  - Establish links to other RMMS components
  - Implement new analytic and report-generation capabilities
  - Deploy full IM/EM integration with RMMS

#### **5.3.5 Prerequisites**

The milestones associated with this program area are predicated on the following:

- Completion of the VDOT infrastructure and communications backbone.
- Implementation of the RMMS.
- Automation of local CAD functions.

#### **5.3.6 Summary of Benefits**

Key Regional benefits expected as a consequence of full CAD integration and related activities include:

- *Enhanced safety and security*, as the ability to detect and respond to incidents and emergencies improves.

- *Enhanced first-responder safety*, as communications among responders improves and the total time required on-scene drops.
- *Improved operations*, as initial dispatching becomes more accurate and there is greater situational awareness between the STC's and the on-scene personnel.
- *Enhanced mobility and customer satisfaction*, as clearance times are reduced and traffic is better managed during the pre-clearance periods.

### **5.3.7 Estimated Development Costs**

Preliminary costs for developing and integrating the CAD systems, etc. during the three principal time periods are estimated as follows:

<b>Near-Term Period</b>	<b>IM/EM Procedures</b>	<b>\$ 750,000</b>
	<b>CAD Integration I</b>	<b>3,000,000</b>
<b>Mid-Term Period</b>	<b>CAD Integration II</b>	<b>2,500,000</b>
	<b>Real-Time Messaging</b>	<b>1,500,000</b>
<b>Long-Term Period</b>	<b>CAD Integration III</b>	<b><u>4,850,000</u></b>
<b>TOTAL ESTIMATED COST</b>		<b>\$12,600,000</b>

The costs shown for the mid-term period pertain to standardizing and linking the local CAD and TMS systems only — they do not include initial automation of the local systems. Also, the costs shown do not reflect the expense of installing communications cable across the Region.

## **5.4 Transportation Management**

The Transportation Management program area focuses on more effective management of traffic and transit management activities. It begins with integration of the VDOT STC, municipal TMS, and HRT transit management infrastructures. It then emphasizes enhanced traffic detection capabilities. The program area concludes with implementation of new predictive/responsive and adaptive capabilities.

Six sets of projects are envisioned in this program area. They are:

- Centralize Traffic Control — Complete VDOT STC Implementation Phases 3,
- Centralize Traffic Control — Complete VDOT STC Integration & Software Development,
- Centralize Traffic Control — Operationalize Local STC's,
- Enhance Traffic Detection,
- Implement Predictive/Responsive Capabilities, and
- Implement Adaptive Capabilities.

Several of the earlier projects overlap with activities already underway across Hampton Roads.

### **5.4.1 Vision**

In 2026, surface transportation managers have the tools at their disposal to detect and monitor traffic flows on freeways and other major arterials, to instantaneously identify disruptions to the normal flow, to predict how those disruptions will affect traffic, and to take steps to ameliorate the adverse flow conditions so that the system can return quickly to "normal." Signalization across the Region is traffic-responsive and, under most circumstances, traffic management systems automatically adapt to predicted conditions. Transportation managers routinely apprise other agencies, appropriate private entities, and travelers about traffic conditions.

### **5.4.2 Discussion**

It is intended that this program area address the key Regional traffic management issues identified by participants in the strategic planning process. These issues include: (1) chronic traffic back-ups at key facilities, such as the Hampton Roads Bridge-Tunnel; (2) inadequate information on traffic flows due to incomplete detection capabilities on major arterials; (3) outdated traffic signal systems without central control; (4) congested work zone areas; (5) inadequate coordination between and within agencies on the status of roads, bridges, and tunnels; and (6) major Regional special events, such as the planned 2007 Jamestown celebration.

The solutions proposed in this program area extend condition-detection capabilities across most of the Region and create an infrastructure for receiving, interpreting, exchanging, and disseminating the detected data. Ultimately envisioned is a dynamic, inherently adaptable Regional transportation network that is capable of adjusting and responding to actual and predicted traffic conditions.

While much emphasis in this program area is on traffic, the potential significance of transit management activities should not be underplayed. As detection and prediction capabilities are enhanced, the efficiency and reliability of transit services should improve as well; this, in turn, will likely make transit a more attractive option to consumers of transportation services. Physical and institutional linkages between traffic and transit management systems are vital.

### **5.4.3 Strategy**

This program area focuses on staged, incremental improvements in the ability to detect and monitor service interruptions and provide automated traffic operation responses at intersections, bottlenecks, and other capacity shortfalls. The stages begin with completing the build-out of commitments to current technology detection and proceed to software and hardware upgrades that improve levels of information (speeds and travel time) and early problem detection and prediction at key locations; it is recognized that these capabilities will be dependent on probes and other to-be-implemented projects. During all three time intervals, a broadening set of interconnections with Regional centers is assumed.

#### **5.4.4 Phased-Implementation Approach**

Key recommended solutions, by time period and project details, are summarized below:

##### **Near-Term Period (2004-2009)**

###### ***Project 1: Centralize Traffic Control — Complete VDOT STC Implementation Phases 3 (Ongoing)***

- *Operational Description:*
  - Enables freeway detection and monitoring
  - Establishes communications “backbone” for Region
  - Disseminates traffic information
  - This ongoing project is underway
- *Key Systemic Components:*
  - Point-detection hardware (348 acoustic sensors and 908 embedded loop detectors)
  - Point-detection/weigh-in-motion hardware (18 piezoelectric sensors)
  - Monitors (170 CCTV cameras)
  - Roadside traveler information (93 changeable message signs)
  - Communications infrastructure (304 roadway miles of fiber optic cable to be installed; 63 roadway miles of cable laid to date)
- *Development Approach:*
  - Complete incremental builds per implementation plans
  - Connect local STC's to communications infrastructure

###### ***Project 2: Centralize Traffic Control — Complete VDOT STC Integration & Software Development (Ongoing)***

- *Operational Description:*
  - Enhances incident detection
  - Integrates VDOT STC and enhances information processing
  - This ongoing project is underway
- *Key Systemic Components:*
  - STC hardware
  - STC software enhancements
  - Communications system
  - Interface protocols
- *Development Approach:*
  - Complete incremental builds per implementation plans

### **Project 3: Centralize Traffic Control — Operationalize Local STC's (Ongoing)**

- *Operational Description:*
  - Develops and deploys centralized operations in key jurisdictions
  - Operations include traffic signal control, traffic signal preemption/priority, and arterial monitoring
  - Ongoing development activities are underway in Chesapeake, Hampton, Newport News, Portsmouth, Suffolk, and Virginia Beach
  - Development in Norfolk is substantially completed and the system is operational
  - Ongoing development is also underway in the VDOT Hampton Roads District
- *Key Systemic Components:*
  - Traffic signal controllers
  - Traffic signal preemption/priority equipment at intersections
  - System detectors & permanent count stations
  - Detection equipment (intersection stop line point detectors & flood)
  - Monitors (CCTV video cameras)
  - TMS hardware
  - TMS software
  - Communications system and infrastructure
  - Interface protocols
- *Development Approach:*
  - Complete one-time builds per jurisdiction
  - Connect to VDOT "backbone" for video- and data-sharing
  - Extend roadway monitoring to arterials

### **Project 4: Enhance Traffic Detection**

- *Operational Description:*
  - Completes, improves, and expands traffic management capabilities
  - Synthesizes data inputs from VDOT and municipalities
  - Integrates data inputs from HRT
  - Implements capability to monitor vehicle movements in order to gauge corridor speeds and travel times
  - Links synthesized data to RMMS
- *Key Systemic Components:*
  - Point-detection equipment (e.g., loop detectors, acoustic detection, radar detection, video detection)
  - Probes and detectors for assessing corridor conditions (e.g., AVL data, toll-tag transponder data, and AirSage data)
  - HRT's Advanced Communications System for radio and CAD/AVL system
  - RMMS software enhancement — algorithm to calculate speeds and travel times from probe and detector data
  - Communications link between VDOT and HRT

- *Development Approach:*
  - Analyze roadway data to define algorithms
  - Design speed and travel time algorithms
  - Test and implement algorithms
  - Integrate data
  - Exchange information and disseminate data

### **Mid-Term Period (2010-2017)**

#### ***Project 5: Implement Predictive/Responsive Capabilities***

- *Operational Description:*
  - Continues build-out of centrally-controlled traffic signal systems
  - Develops and implements predictive algorithm tools to predict conditions and outcomes under various freeway scenarios
  - Extends predictive algorithm capabilities to major arterials under municipal jurisdictions
  - Develops and implements centrally-controlled condition/responsive action plans that are automatically executed once “approved” by designated staff overseeing freeway management
- *Key Systemic Components:*
  - Enhanced field detection equipment
  - RMMS software enhancements — predictive/responsive algorithms
  - Municipal TMS software enhancements
  - Interface protocols
- *Development Approach:*
  - Examine state-of-art traffic prediction and condition/responsive algorithms
  - Design predictive/responsive algorithms
  - Test and implement algorithms
  - Integrate data
  - Exchange information and disseminate data

### **Long-Term Period (2018-2026)**

#### ***Project 6: Implement Adaptive Capabilities***

- *Operational Description:*
  - Adds adaptive systems, which enable automatic, real-time response to traffic conditions, to VDOT’s Freeway Management System
  - Adds adaptive systems to the cities’ traffic signal systems on major arterials
- *Key Systemic Components:*
  - Enhanced field detection equipment
  - RMMS software enhancement — adaptive algorithms
  - Local STC software enhancements
  - Interface protocols

- *Development Approach:*
  - Complete build-out of detection and prediction capabilities
  - Examine state-of-art adaptive algorithms
  - Examine data stored in RMMS
  - Design adaptive algorithms based on detection data
  - Test and implement algorithms

#### **5.4.5 Prerequisites**

The milestones associated with this program area are predicated on the following:

- Centralization of traffic operations control, as described in Projects 1-3 of this program area. These three projects are all currently underway.
- Implementation of the RMMS.

#### **5.4.6 Summary of Benefits**

Key Regional benefits expected as a consequence of enhanced Transportation Management capabilities include:

- *Enhanced mobility and heightened customer satisfaction*, as traffic through-put and flow speeds improve; intersection stop times, left-turn delays, and overall travel times decrease; and fuel-consumption and pollution-emissions levels drop.
- *Improved operations*, as detection capabilities are enhanced and system responsiveness during unplanned events improves.

#### **5.4.7 Estimated Development Costs**

Preliminary costs for developing and implementing the Transportation Management functions during the three principal time periods are estimated as follows:

<b>Near-Term Period</b>	<b>Central Traffic Control/STC</b>	<b>\$28,900,000</b>
	<b>Implementation</b>	
	<b>Central Traffic Control/STC</b>	<b>4,800,000</b>
	<b>Integration</b>	
	<b>Central Traffic Control/Local STC's</b>	<b>34,581,000</b>
	<b>Enhance Traffic Detection</b>	<b>5,000,000</b>
<b>Mid-Term Period</b>	<b>Predictive/Responsive Capabilities</b>	<b>6,000,000</b>
<b>Long-Term Period</b>	<b>Adaptive Capabilities</b>	<b><u>11,000,000</u></b>
<b>TOTAL ESTIMATED COST</b>		<b>\$90,281,000</b>

The costs shown include funds already committed to Projects 1-3.

## **5.5 Systems Management**

This program area, fundamentally, focuses on two categories of systems: (1) asset management systems, and (2) automated enforcement systems. The former is comprised of asset management software and fleet management systems, including AVL systems; it also encompasses over-size vehicle detection systems, because such vehicles can cause substantial damage to the transportation infrastructure, particularly when traveling in tunnels and across bridges. Automated enforcement includes red-light running, speed-limit enforcement, and HOV-lane compliance systems.

Six sets of projects are covered in this program area. They are:

- Perform an Assessment of Assets,
- Implement Fleet Management Capabilities,
- Implement Automated Detection-and-Warning Systems,
- Expand Fleet Management Capabilities,
- Manage Automated Enforcement Programs, and
- Implement Asset Monitoring and Real-Time Management.

Regional asset management data will be available to designated stakeholders via the RMMS.

### **5.5.1 Vision**

In 2026, transportation managers utilize computing and communications technologies to provide them “visibility” over the surface transportation system, enabling them to respond efficiently to disruptions, e.g., natural disasters or vehicle crashes, as well as to take steps to prevent disruptions, e.g., ensuring protection of critical assets against terrorist attack and power failures. In turn, computing and communications systems are managed by well-trained personnel with adequate resources to operate and maintain those systems. Operational agreements are in place to ensure adequate coordination among responsible agencies.

### **5.5.2 Discussion**

Hampton Roads faces a host of challenges in managing its surface transportation system. These challenges, as identified by participants in the strategic planning process, include the following: (1) threats to critical assets from terrorism and natural disasters; (2) not always knowing the precise location of potential responders and other emergency vehicles when incidents occur; (3) lack of a fully interoperable communications infrastructure; (4) non-compliance with HOV-lane rules and red-light running; and (5) over-height commercial vehicles damaging, or potentially damaging, the Region’s tunnels.

Transportation managers today must be multi-faceted and multi-talented. Their jobs entail managing the transportation system itself, i.e., the physical roadway and transit networks,

traffic and transit assets, etc. However, their jobs extend to the computerized systems, communications technologies, etc. that help manage the physical networks and assets.

This program area emphasizes the development and deployment of some of these key management systems.

### **5.5.3 Strategy**

Effective management requires knowledge of characteristics of both fixed and operational assets. This process will be driven, in part, by changes in the marketplace, as state-of-the-practice technologies emerge and automated systems evolve. Making these technologies and systems work often requires a range of sophisticated communications technologies.

### **5.5.4 Phased-Implementation Approach**

Key recommended solutions, by time period and project details, are summarized below:

#### **Near-Term Period (2004-2009)**

##### **Project 1: Perform an Assessment of Assets**

- *Operational Description:*
  - Inventories Region-wide transportation assets (roadway & transit)
  - For “mission-critical” assets, defines security plans, back-up facilities plans, electrical and communications back-up plans, etc.
  - Automates inventory
- *Key Systemic Components:*
  - Database
  - RMMS module
- *Development Approach:*
  - Identify transportation assets across Region, including infrastructure, facilities, & equipment
  - Perform analyses to determine which assets are “mission critical”
  - Assess vulnerabilities of “mission critical” assets
  - Develop countermeasures to ensure those assets are usable or accessible under severe emergency conditions
  - Implement asset database within RMMS

##### **Project 2: Implement Fleet Management Capabilities**

- *Operational Description:*
  - Installs AVL systems on HRT buses, Freeway Incident Response Team (FIRT) vehicles, and VDOT maintenance vehicles
  - Implements fleet management capabilities

- *Key Systemic Components:*
  - AVL in-vehicle equipment
  - AVL communications and support infrastructure
  - HRT CAD/AVL management software
  - VDOT fleet management system
  - RMMS module
- *Development Approach:*
  - Research and select suitable AVL technology for Region
  - Ensure compatibility of HRT and VDOT AVL systems; coordinate activities with VSP, other state agencies, and municipalities involved with AVL
  - Research and define range of fleet management functions desired
  - Install and implement AVL
  - Develop and implement fleet management modules in the RMMS

### ***Project 3: Implement Automated Detection-and-Warning Systems***

- *Operational Description:*
  - Automatically detects over-sized commercial vehicles at additional strategic tunnel and roadway locations
  - Advises drivers of their over-size status and alternative routing for bypassing the problem location
  - Determines whether other types of detection-and-warning systems are needed across the Region
- *Key Systemic Components:*
  - Detection-and-warning systems
  - Dynamic message signs
  - Systems management software
- *Development Approach:*
  - Determine optimal locations for installing detection-and-warning systems — i.e., locations that will minimize traffic disruptions while vehicles are measured, but also allow easy re-routing of vehicles
  - Deploy systems

### **Mid-Term Period (2010-2017)**

### ***Project 4: Expand Fleet Management Capabilities***

- *Operational Description:*
  - Extends AVL coverage to additional fleets, e.g., municipal maintenance vehicles
  - Integrates AVL with other management systems, e.g., transit scheduling system, passenger counters, etc. at HRT
  - Adds vehicle diagnostic capabilities, e.g., engine maintenance sensors
- *Key Systemic Components:*
  - AVL systems

- Vehicle diagnostics systems
- Fleet management systems
- Integration software
- RMMS module
- *Development Approach:*
  - Implement AVL on additional fleets
  - Integrate AVL with other management systems
  - Identify additional fleet management functions desired
  - Develop and implement additional fleet management modules in the RMMS

### ***Project 5: Manage Automated Enforcement Programs***

- *Operational Description:*
  - Deploys enforcement technologies likely to have a positive impact on safety and mobility
  - Candidate technologies include detection of red-light running, speed-limit violations, and improper use of HOV lanes
  - Deploys and manages automated enforcement programs
- *Key Systemic Components:*
  - Sensor and detection systems
  - Communications systems
  - Databases and tracking systems
  - Management software
- *Development Approach:*
  - Research candidate technologies, including their respective impacts on Regional safety and mobility, legal issues, operational resources and requirements, etc.
  - Determine whether to administer programs in-house or out-source
  - Plan and deploy enforcement programs

### **Long-Term Period (2018-2026)**

### ***Project 6: Implement Asset Monitoring and Real-Time Management***

- *Operational Description:*
  - Links together the asset and fleet management functions
  - Enables real-time “visibility” of all major assets, e.g., bridges and vehicles
  - Makes available instant status of assets through the RMMS
  - Supports informed management decision-making based on up-to-the-minute data
- *Key Systemic Components:*
  - Asset management system
  - Fleet management system
  - Integration software

- RMMS module
- *Development Approach:*
  - Integrate asset and fleet management systems with the RMMS

### **5.5.5 Prerequisites**

The milestones associated with this program area are predicated on implementation of the RMMS.

### **5.5.6 Summary of Benefits**

Key Regional benefits expected as a consequence of enhanced Systems Management include:

- *Improved mobility and operations*, as fleet vehicles and other assets are “visible” to operations center staff. Fleet management of transit and other vehicles further supports enhanced schedule adherence, improvements in routing and diversion, more rapid response when vehicles are involved in incidents, etc.
- *Enhanced safety and security*, as vehicles and other assets are routinely or continuously monitored.
- *Improved traveler information and customer satisfaction*, as transit vehicle and delivery service information becomes increasingly accurate and reliable.
- *Enhanced safety and security*, as hazardous traffic violations are identified through automated enforcement.

### **5.5.7 Estimated Development Costs**

Preliminary costs for developing and implementing the Systems Management functions during the three principal time periods are estimated as follows:

<b>Near-Term Period</b>	<b>Assessment of Assets</b>	<b>\$ 600,000</b>
	<b>Initial Fleet Management</b>	<b>10,000,000</b>
	<b>Automated Detection-and-Warning</b>	<b>2,000,000</b>
<b>Mid-Term Period</b>	<b>Expanded Fleet Management</b>	<b>5,000,000</b>
	<b>Automated Enforcement Programs</b>	<b>10,000,000</b>
<b>Long-Term Period</b>	<b>Asset Monitoring/Real-Time Management</b>	<b><u>4,000,000</u></b>
<b>TOTAL ESTIMATED COST</b>		<b>\$31,600,000</b>

The costs shown are exclusive of most communications costs.

## **5.6 Traveler Information**

On a core level, traveler information systems have the potential capacity to empower customers, offering them sufficient information to make informed decisions about appropriate routing, whether to begin or defer a trip, or detour around a planned route because traffic conditions have suddenly worsened. In the world of the not-too-distant future, detailed and reliable information should be available both to customers planning a trip and those already en-route to their destinations.

This program area covers three sets of projects. They are:

- Launch 511 and Revitalize ATIS,
- Link RMMS “Info-Feed” to 511/ATIS, and
- Fuse Traveler Information Data.

Ideally, roadway customers and customers of transit services should all have routine access to traveler information.

### **5.6.1 Vision**

In 2026, commuters, tourists, truck drivers, bus drivers, and others about to travel, or already traveling, have access to real-time and reliable information about traffic and travel conditions. When appropriate, travelers will be provided with route alternatives and with adequate information to make informed decisions about those alternatives. Traveler information will be available via a range of personal devices (e.g., computers, portable phones, and personal digital assistants), in-vehicle systems (e.g., highway advisory radio and navigation systems), and infrastructure-based systems (e.g., dynamic message signs and passenger information systems at bus stops).

### **5.6.2 Discussion**

Everyone wins when traveler data is informative and reliable. Roadway users spend less time on the road and that, in effect, increases capacity for other travelers. Also, anecdotal evidence suggests that drivers who are not constantly frustrated by adverse roadway conditions are less likely to drive aggressively. In a similar vein, occasional users of transit services are likely to become long-term customers when they can count on buses arriving and delivering them to their destinations in accordance with scheduled services.

Therefore, two essential challenges to effective traveler information are ensuring data currency and data reliability. Travelers will stop using information services quickly when they find that they cannot count on the data.

The Region's ability to provide traveler information has been hampered in the past by the lack of a standardized approach to packaging and disseminating data, and a dearth of useful information. Other issues include: (1) tailoring appropriate traveler information efforts to different categories of stakeholders, e.g., commuters, tourists, and ports and military personnel; (2) the availability of data of sufficient quality to create reliable traveler information; (3) the need for predictive tools to enable reliable projections of delay times, and (4) the role of public versus private sectors in furnishing traveler information.

### **5.6.3 Strategy**

A national 511 program has been developed and is being implemented on a state-by-state basis, including standardized formats for telephone and web access, user menus, and reporting. While the system is still reliant on available public and private sector data, it establishes a basic service level and point-of-departure for subsequent enhancements as the available travel conditions data are improved.

### **5.6.4 Phased-Implementation Approach**

Key recommended solutions, by time period and project details, are summarized below:

#### **Near-Term Period (2004-2009)**

##### ***Project 1: Launch 511 and Revitalize ATIS***

- *Operational Description:*
  - Implements basic 511 service that enables dissemination of transportation information via (1) phone service (dial "511"), and (2) Regional web site
  - Revitalizes Regional ATIS (Advanced Traveler Information System) to include expanded video-sharing and enhanced highway advisory radio (HAR)
- *Key Systemic Components:*
  - RMMS data pump
  - Regional web site/transportation map
  - Interface
  - Video hardware
  - ATIS field hardware (e.g., HAR, CMS's, Portable CMS's)
  - Communications infrastructure
- *Development Approach:*
  - Examine current and pre-existing traveler information dissemination efforts, especially those conducted via media outlets, for lessons learned, etc.
  - Plan and implement basic 511 service accessible through wireline & wireless phones and on a public web site
  - Implement a dynamic transportation map on the public web site
  - Expand video-sharing between VDOT, HRT, municipalities, emergency responders, media outlets, etc.
  - Upgrade and expand HAR

- Include basic HRT status data in 511 and ATIS services

### **Mid-Term Period (2010-2017)**

#### **Project 2: Link RMMS “Info-Feed” to 511/ATIS**

- *Operational Description:*
  - Expands the type and sophistication of data available via 511 and ATIS services
  - Expands the type, availability, and currency of HRT passenger information
  - Expands the media by which 511/ATIS data are available to include new state-of-the-practice technologies
- *Key Systemic Components:*
  - RMMS data pump
  - RMMS software enhancements
  - 511/ATIS enhancements
  - Interface
  - Video hardware/enhanced imaging capabilities
  - ATIS field hardware
  - Communications infrastructure
- *Development Approach:*
  - Identify additional data to be made available via 511/ATIS services, including additional HRT data
  - Examine new candidate technologies to “push” information to travelers
  - Develop and implement enhancements
  - Deploy enhanced HRT passenger information systems

### **Long-Term Period (2018-2026)**

#### **Project 3: Fuse Traveler Information Data**

- *Operational Description:*
  - Completes the data-fusion capability in RMMS and pumps the fused data to 511/ATIS outlets
  - Accommodates transfer of next-generation ATIS over the Internet using wireless communications
  - Improves and expands dissemination technologies and techniques, including interfaces with in-vehicle systems
- *Key Systemic Components:*
  - RMMS data pump
  - RMMS software enhancements
  - 511/ATIS enhancements
  - Interface
  - Other technologies, as needed

- *Development Approach:*
  - Complete RMMS III efforts to fuse data for enhanced traveler information
  - Improve and expand dissemination technologies & techniques, including interfaces with in-vehicle systems

### **5.6.5 Prerequisites**

The milestones associated with this program area are predicated on the following:

- Implementation of a statewide 511 system.
- Completion of RMMS, including implementation of data-fusion capabilities.

### **5.6.6 Summary of Benefits**

Key Regional benefits expected as a consequence of Traveler Information improvements include:

- *Improved customer satisfaction*, as travelers and commuters make informed pre-trip and en-route decisions.
- *Enhanced mobility*, as travelers select the optimal routing for a given trip and often divert from — or avoid — problematic routes or corridors.
- *Enhanced safety and security* through the dissemination of real-time incident and emergency information.

### **5.6.7 Estimated Development Costs**

Preliminary costs for developing and implementing the Traveler Information functions during the three principal time periods are estimated as follows:

<b>Near-Term Period</b>	<b>511 and ATIS</b>	<b>\$ 3,000,000</b>
<b>Mid-Term Period</b>	<b>RMMS "Info-Feed"</b>	<b>2,000,000</b>
<b>Long-Term Period</b>	<b>Fuse Traveler Information</b>	<b><u>3,000,000</u></b>
<b>TOTAL ESTIMATED COST</b>		<b>\$ 8,000,000</b>

### **5.7 Program Development and Management**

This program area addresses several important domains for managing Regional ITS activities. These include developing political, public, and other institutional support for ITS; deploying cost-effective, standardized systems; monitoring and maintaining system performance; and institutionalizing good practices. Success in these areas will require comprehensive advanced planning and meticulous program management.

Four sets of projects are included in this program area, as follows:

- Cultivate Champions, Educate the Public, and Train Staff,
- Adopt Regional Configuration Management Procedures and Standards,
- Establish Regional Maintenance Staff for ITS, and
- Implement Structured Systems Migration.

As the Region's ITS program grows and evolves, additional issues will almost certainly need to be addressed within the Program Development and Management arena. These potential issues, which comprise the "institutional layer" of ITS, are identified and discussed in Section 7.0, *Implementation Strategies*, of this report.

### **5.7.1 Vision**

In 2026, mechanisms are in place to effectively coordinate ITS program management activities – both technical and operational – across jurisdictions and agencies. ITS is an integral component of the capital planning process, and the general public and other transportation stakeholders have a rudimentary grasp of basic ITS concepts. Procurement processes are timely and efficient, and enable the Region to acquire the systems and services it needs. Processes and procedures exist for configuration management, systems maintenance, and structured migration to upgraded systems. Resources – both funding and skilled personnel – are sufficiently available to optimize management and operation of the surface transportation system.

### **5.7.2 Discussion**

Participants in the strategic planning process made reference to several key infrastructure-related issues or impediments that need to be addressed before major advances in the area of Program Management and Development can be realized. For example, there is a shortage of skilled technicians to staff the increasingly complex ITS systems environment. Additionally, there is a lack of standardization among jurisdictions and agencies in terms of systems design, communications, data-exchange, etc. In addition to achieving a level of standardization sufficient for data-exchange, standardization offers the additional potential benefit of promoting "economies of scale" through joint hardware and software procurements. A related issue pertains to difficulties associated with transitioning to new systems and technologies, including the management of system configurations.

Another important problem repeatedly cited by participants concerned state and local procedures for procuring and deploying ITS systems. Participants noted that current procurement practices tend to inhibit – rather than promote – effective contracting for ITS systems and services. ITS procurement procedures are frequently perceived to be neither timely nor efficient, and to sometimes result in undesirable outcomes.

An additional recurring obstacle is the general absence of regional champions at the policymaker level and from outside the immediate transportation community. In general, participants in the strategic planning process see the need for basic ITS education directed at policymakers, transportation and public works staffs, non-transportation groups, and the general public.

Some of the key challenges noted above are addressed under this program area. Others constitute broad-based institutional issues and are addressed later in this document, in Section 7.0, *Implementation Strategies*.

### **5.7.3 Strategy**

Capitalizing on ITS and systems operations requires “institutionalizing” project and program development within the mainstream of state and local government agencies – both transportation, public safety, and other agencies. A staged evolution is designed to gradually move from the informal “stove-piped” activities of staff supporters to a regular, resource-sustainable program with plans, program budgets, performance assumptions, and accountability. This transition requires public and decision-maker education to build a supportive constituency and explicit demonstrations of benefits.

### **5.7.4 Phased-Implementation Approach**

Key recommended solutions, by time period and project details, are summarized below:

#### **Near-Term Period (2004-2009)**

##### ***Project 1: Cultivate Champions, Educate the Public, and Train Staff***

- *Operational Description:*
  - Communicates an awareness of the operational benefits gained through ITS
  - Trains staff in ITS planning, operations, and maintenance
  - Establishes a Regional ITS & Operational Standards Group to define data-exchange standards, etc.
- *Key Systemic Components:*
  - None
- *Development Approach:*
  - Develop performance goals and measures for all program areas
  - Review/enhance Regional ITS marketing materials
  - Expand ITS O&M education and training
  - Explore, outreach, and cultivate Champions
  - Expand public knowledge of – and experience with – traveler information systems
  - Conduct professional capacity-building training for ITS professionals
  - Develop Regional ITS and Operations data-exchange standards

## **Project 2: Adopt Regional Configuration Management Procedures & Standards**

- *Operational Description:*
  - Prepares a comprehensive inventory of Regional ITS hardware, firmware, software, applications, etc.
  - Uses inventory to establish baseline against which system changes may be documented to establish and maintain interoperability
  - Establishes a Regional ITS Technology Standards Group to define pertinent operational and technology standards
- *Key Systemic Components:*
  - None
- *Development Approach:*
  - Examine state-of-the-practice approaches to configuration management and implement the optimal approach
  - Develop and implement mechanisms for capturing and maintaining configuration management inventory
  - Develop Regional ITS and Operations technology standards

### **Mid-Term Period (2010-2017)**

## **Project 3: Establish Regional Maintenance Staff for ITS**

- *Operational Description:*
  - Defines a comprehensive approach to Regional maintenance of ITS hardware, software, and field devices; the approach should include structure, oversight, parts inventory, prioritization scenarios, funding, etc.
  - Documents the range of ITS maintenance needs and the specific skills required to address those needs
  - Establishes a Regional maintenance team
- *Key Systemic Components:*
  - None
- *Development Approach:*
  - Appoint a task force to promulgate maintenance requirements and standards
  - Develop agreements between VDOT, municipalities, and other agencies on use of the maintenance team, maintenance charges, etc.
  - Set up a maintenance team consistent with the adopted requirements and standards

## **Long-Term Period (2018-2026)**

### **Project 4: Implement Structured Systems Migration**

- *Operational Description:*
  - Defines a migration plan and path for those Regional systems that support ITS and operations
  - Identifies plans, procedures, and protocols for upgrading early/existing systems as they reach the end of their productive lives
  - Identifies plans, procedures, and protocols for replacing broken or defective ITS components
  - Implements systems migration procedures and monitor activities
- *Key Systemic Components:*
  - RMMS configuration management module
- *Development Approach:*
  - Benchmark useful life of ITS components by type
  - Establish general timetables for major system upgrades
  - Execute the migration plan
  - Track replacement/upgrade activities and status

### **5.7.5 Prerequisites**

The milestones associated with this program area assume that many of the institutional issues identified in Section 7.0, *Implementation Strategies*, are completed or in progress.

### **5.7.6 Summary of Benefits**

Key Regional benefits expected as a consequence of improvements to Program Development and Management include:

- *Improved customer satisfaction*, as customers and policymakers increasingly understand how ITS and traveler information, etc. can best be utilized.
- *Improved operations*, as configuration management is institutionalized, lessons learned are tracked and routinely exchanged among practitioners, Regional standards are established, and Region-wide maintenance activities are implemented.

### **5.7.7 Estimated Development Costs**

Preliminary costs for developing and implementing the Program Development and Management functions during the three principal time periods are estimated as follows:

<b>Near-Term Period</b>	<b>Education and Training</b>	<b>\$ 500,000</b>
	<b>Configuration</b>	<b>500,000</b>
	<b>Management</b>	
<b>Mid-Term Period</b>	<b>Regional Maintenance</b>	<b>600,000</b>
	<b>Team</b>	
<b>Long-Term Period</b>	<b>Systems Migration</b>	<b><u>1,000,000</u></b>
<b>TOTAL ESTIMATED COST</b>		<b>\$ 2,600,000</b>

## 6.0 IMPACTS OF THE STRATEGIC VISION ON THE REGIONAL ARCHITECTURE

By definition, ITS Architectures are living documents that should be revisited and updated to reflect changes to a region. Since its inception, Hampton Roads has revisited the architecture several times to ensure that it accurately depicts the current status of the Region. The first Regional Architecture was developed for the original *COMPARE* plan and was updated in the *2000 COMPARE Update* to reflect the Region at that time.

Since 2000, the ITS system in Hampton Roads has changed. The architecture has been updated in this report to reflect the current status of the Region. It has also been presented in a new format in order to provide more in-depth information. The updated Architecture further defines the agencies, subsystems, operating systems, and information flows in the Region.

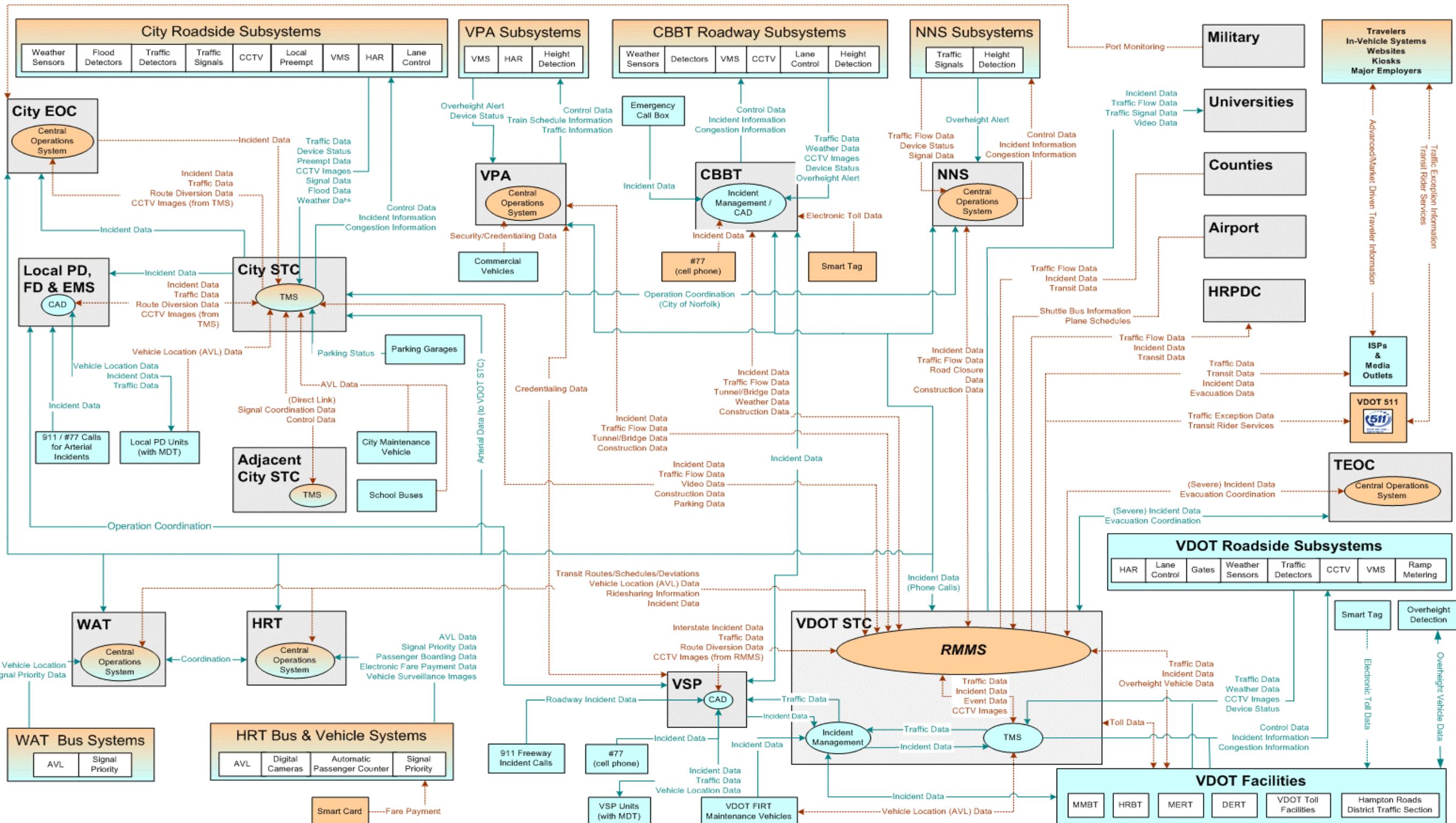
While the Architecture was updated to reflect the current status, it also portrays future ITS system components, interconnects, and information flows. In particular, the Architecture defines interoperability between agencies through the RMMS. The information contained for future systems in the Architecture comes from the following sources: (1) planned projects identified by jurisdictions in the inventory updates, (2) outreach meetings with transportation and non-transportation agencies during the process of updating this Strategic Plan, and (3) future projects recommended in this Strategic Plan.

The updated Hampton Roads Regional ITS Architecture, together with a legend and list of abbreviations, follows.

Legend		Abbreviations:
<b>Element</b>	Element (Physical Entity)	ATIS: Advanced Traveler Information System
	Existing Element/Subsystem	AVL: Automatic Vehicle Location
	Planned Element/Subsystem	CAD: Computer Aided Dispatch
	Existing/Planned Element/Subsystem	CBBT: Chesapeake Bay Bridge-Tunnel
	Existing Information Flow	CVO: Commercial Vehicle Operators
	Planned Information Flow	DERT: Downtown Elizabeth River Tunnel
	System (shown as planned)	EOC: City Emergency Operations Center
	Information Flow going to an Element	EMS: Local Emergency Management Service Providers
	Information Flow going to a System (shown as planned)	FD: Fire Department
		FIRT: Freeway Incident Response Team (Vehicle)
		HRBT: Hampton Roads Bridge-Tunnel
		HRPDC: Hampton Roads Planning District Commission
		HRT: Hampton Roads Transit
		ISP: Information Service Provider
		MDT: Mobile Data Terminal (in police vehicles)
		MERT: Midtown Elizabeth River Tunnel
		MMBT: Monitor-Merrimac Memorial Bridge-Tunnel
		NNS: Norfolk Naval Station
		PD: Police Department
		RMMS: Regional Multimodal Management System
		STC: Smart Traffic Center
		TEOC: Transportation Emergency Operations Center
		TMS: Traffic Management System
		VDOT: Virginia Department of Transportation
		VPA: Virginia Port Authority
		VSP: Virginia State Police
		WAT: Williamsburg Area Transport



**Hampton Roads Regional ITS Architecture (2004 View)**





## **6.1 Maintaining the Architecture**

A significant effort was exerted to make the Regional ITS Architecture as comprehensive as possible in identifying and documenting appropriate and applicable exchanges of data and information in the Hampton Roads Region. As ITS projects are implemented, the Regional ITS Architecture needs to be updated to reflect new priorities and strategies that emerged through the transportation planning process, to account for expansion in ITS scope, and to allow for the evolution and incorporation of new ideas. The purpose of maintaining a Regional ITS Architecture is to keep it current and relevant, so that stakeholders will use it as a technical and institutional reference when developing specific ITS project plans. As conditions in a region evolve, so should the Architecture.

Regional ITS Architectures are living documents and must be maintained so they continue to reflect the current and planned ITS systems, interconnections, and other aspects of the Architecture. The following list includes many of the events that may cause change to a Regional ITS Architecture:

- *Changes in Regional needs:* Regional ITS Architectures are created to support transportation planning in addressing regional needs. Over time, these needs can change and the corresponding aspects of the Regional ITS Architecture that address these needs may need to be updated. These changes in needs will also typically be expressed in updates to planning documents such as the Regional Transportation Plan.
- *New stakeholders:* As new stakeholders become active in ITS, the Regional ITS Architecture should be updated to reflect their place in the regional view of ITS elements, interfaces, and information flows. Why might new stakeholders emerge? The stakeholders might represent new organizations that were not in place during the original Architecture development. Maybe the geographic scope of the Architecture is being expanded, bringing in new stakeholders. Perhaps additional transportation modes or transportation services are being considered that touch the systems of additional stakeholders.
- *Changes in scope of services considered:* The range of services considered by the Regional ITS Architecture expands. This might happen because the National ITS Architecture has been expanded and updated to include new user services or to better define how existing elements satisfy the user services. A Regional ITS Architecture based on an earlier version of the National ITS Architecture should take into consideration these changes as the Regional ITS Architecture is updated. The National ITS Architecture may have expanded to include a user service that has been discussed in a region, but not included in the Architecture, or was included in a cursory manner. Changes in the National ITS Architecture are not of themselves a reason to update a Regional ITS Architecture, but a region may want to consider any new services in the context of their regional needs.
- *Changes in stakeholder or element names:* An agency's name or the name used to describe their element(s) undergoes change. Transportation agencies occasionally

merge, split, or just rename themselves. In addition, element names may evolve as projects are defined. The Regional ITS Architecture should be updated to use the currently correct names for both stakeholders and elements.

- *Changes in other architectures:* A Regional ITS Architecture covers not only elements and interfaces within a region, but also interfaces to elements in adjoining regions. Changes in the Regional ITS Architecture in one region may necessitate changes in the architecture in an adjoining region to maintain consistency between the two. Architectures may also overlap (e.g. a Statewide Architecture and a Regional Architecture for a region within the state) and a change in one might necessitate a change in the other.

There are several changes relating to project definition that will cause the need for updates to the Regional ITS Architecture:

- *Changes due to Project Definition or Implementation:* When actually defined or implemented, a project may add, subtract or modify elements, interfaces, or information flows from the Regional ITS Architecture. Because the Regional Architecture is meant to describe the current (as well as future) regional implementation of ITS, it must be updated to correctly reflect how the developed projects integrate into the region.
- *Changes due to Project Addition/Deletion:* Occasionally a project will be added or deleted through the planning process or even during project delivery. Some aspects of the Regional ITS Architecture that are associated with the project may be expanded, changed, or removed.
- *Changes in Project Priority:* Due to funding constraints, or other considerations, the planned project sequencing may change. Delaying a project may have a ripple effect on other projects that depend on it; conversely, raising the priority for a project's implementation may impact other projects that are related to it.

These changes to the Regional ITS Architecture baseline may happen frequently or infrequently, depending upon the region and the specifics of the original Regional ITS Architecture development effort. This should be taken into account in determining how often to update the Architecture.

Three decisions must be discussed in the Hampton Roads Region to identify how to maintain the Architecture. These decisions include:

1. Who will lead and implement the Architecture maintenance effort?
2. On what schedule will the Regional ITS Architecture change?
3. What parts of the Regional ITS Architecture will be maintained?

Although to some extent all stakeholders need to participate, typically one or two agencies will take the lead responsibility to maintain the Architecture. The Hampton Roads Region currently does not have an agency assigned to maintain the Architecture for the Region.

An agency should be identified in the near future that is prepared to lead the maintenance of the Architecture.

In addition to defining who will be responsible for maintaining the Architecture, the Region must also decide when to update the document. There is no set timetable to apply to every region. A timetable should be chosen depending on several factors including how the Regional ITS Architecture is used and the funding/staffing available for the task.



## 7.0 IMPLEMENTATION STRATEGIES

The Plan to this point has laid out some options with regard to further development of transportation systems in the Hampton Roads Region. This section will focus on the implementation strategies required to move the Region forward. In many ways, the implementation strategies are the keystone of this Plan because they need to be carried forward in order to maximize the implementation and benefit of new regional systems.

The strategies described in this section are more focused on institutional and organizational issues facing the Region. These issues must be tackled head-on to ensure the Region moves towards enhanced transportation system performance.

### 7.1 National Thinking on ITS

Over the past 30-40 years, transportation practitioners have worked through different approaches to improving operations and management of the transportation system. Some see the following developments:

**Table 7.1 Generations of Thinking and Associated Strategies**

Generation of Thinking	Strategies
First Generation	<ul style="list-style-type: none"><li>• Transportation Systems Management (TSM)</li><li>• Congestion Management Systems</li></ul>
Second Generation – ITS-focused	<ul style="list-style-type: none"><li>• ITS early deployment plans</li><li>• ITS master plans</li><li>• Long range ITS plans</li></ul>
Third Generation – New state of the practice	<ul style="list-style-type: none"><li>• Transportation system operations and management (TSOM)</li><li>• Built around ITS</li></ul>

For purposes of this Plan, TSOM — part of the current or Third Generation — is defined as:

*Active management of the existing transportation system to maintain customer-focused performance in the face of congestion, incidents and other service disruptions.*

While TSOM is built around ITS, ITS is not seen as the solution. Rather ITS is now seen as providing core technologies to enable active management and operations of the transportation system.

Typical differences between the Second and Third Generations are reflected in the following table:

**Table 7.2 Differences between 2<sup>nd</sup> and 3<sup>rd</sup> Generations of ITS**

Second Generation ITS	Third Generation ITS
Focus on projects	Focus on performance
Capital budget consensus	Operations consensus and commitments
Constrained by capital costs	Concerned with operating costs (staffing, equipment maintenance)
State DOT's and local traffic/public works departments	Transportation (including transit) and public safety entities (and private sector)
Priority on architecture	Priority on concepts of operations as well as architecture
Technology is the solution	Service – using technology as a tool – is the solution
MPO leading planning	MPO convening forum(s) for operational consensus

## **7.2 Driving Forces behind Transportation Systems Operations and Management**

The driving forces behind the Third Generation transportation systems operations and management strategy are several including increasing traffic congestion and resource constraints on construction of new capacity.

### **7.2.1 Cost of Congestion**

The Annual Urban Mobility Report — a widely acknowledged study by TTI — recently released 2001 statistics that indicate an average yearly cost of \$520 per person due to congestion in 75 urban areas in the United States. These costs include an average of 26 hours in delay and 42 gallons of wasted fuel per person. Average yearly costs in the Hampton Roads Region were estimated at \$261 per person while delay was estimated at 13 hours and wasted fuel at 22 gallons per person.

There are considered to be two types of congestion: Recurring and non-recurring. Recurring congestion occurs when more vehicles travel on the highways than what those roads were designed to efficiently carry, leading to reduced speeds and congestion. This type of congestion is referred to as recurring because it tends to occur day-after-day, often at the same times and in the same locations.

Non-recurring congestion occurs due to factors such as automobile crashes, breakdowns, construction, and weather conditions. Table 7.3 below highlights some of the differences between the two types of congestion. In the Hampton Roads Region, TTI estimates that 61% of total delay in the Region is due to non-recurring conditions, higher than the national average.

**Table 7.3 Types of Congestion with Usual Mitigation Strategy**

Type of Congestion	Representative Causes of Delay	Mitigation Strategy
<b>Recurring</b>	Infrastructure capacity shortfalls	Capacity increases
	Interchange bottlenecks	
	Weave and merge friction	
	Non-optimized traffic signal timing*	
<b>Non-Recurring</b>	Breakdowns and crashes	Transportation Systems Operations and Management
	Construction work	
	Weather	
	Vehicle mix	

\* Note that while non-optimized signal timing will lead to recurring congestion, it is addressed through better operations and management, not new capacity.

In addition to factors such as wasted fuel and delay, non-recurring congestion often has a detrimental effect on safety. For example, automobile crashes often lead to secondary crashes with more severe effects than the first. Work zone alignments and weather can also lead to diminished safety. Therefore, non-recurring congestion must be addressed to eliminate or diminish the negative effects on mobility, safety, the environment and the economy.

Five strategies identified by TTI as partial remedies to congestion, especially when used together include:

- Traffic signal coordination program,
- Freeway incident management programs,
- Freeway entrance ramp metering,
- Public transportation service, and
- High occupancy vehicle lanes.

## 7.2.2 Revenue Shortfalls for New Capacity

In the past, highways were built and then there was comparatively little emphasis on effectively operating and managing day-to-day traffic on the highway system. As resources for new construction have become scarcer, and as highways have become more congested, attention has been focused on strategies to more effectively move traffic on a day-to-day basis. Applying a range of such strategies will collectively decrease levels of congestion and delay, increasing the reliability of travel times. These strategies also provide greater safety to the traveling public.

The TTI report states that, in considering estimated growth levels in the 75 urban areas studied, current spending for new road construction needs to be at least doubled in order to prevent a worsening in today's congestion levels. In general, new construction is viewed as an appropriate response to recurring congestion. TTI points out that, because raising

highway construction budgets to these levels is unlikely, adding travel capacity through new construction can only serve as part of the total solution to solving congestion.

Virginia has been hit hard on transportation funding, especially funding for new construction. In the 2026 Plan, no growth in VDOT highway construction funds is assumed. If that assumption holds true, then additional new construction will only occur with alternative funding sources such as tolling, other regionally collected resources or more federal funds flowing directly to the Region. In a resource-constrained situation, transportation systems operations and management – while addressing about half of the congestion on the highways – is typically less costly than new construction.

### **7.2.3 Other Driving Forces**

Increasing congestion and revenue shortfalls are only two of the reasons for focusing more attention on system operations and management. Some of the other driving forces behind enhanced operations and management include:

- Higher expectations and demands for increased accountability from the public for better system performance,
- Increasingly better understanding of the causes of, and cures to, congestion and delay,
- Availability of more tools to operate and manage the system to help achieve better travel time reliability,
- Heightened emergency management/security needs,
- Environmental requirements,
- Special circumstances such as regular special events, and
- Desire for increased safety.

## **7.3 Current State of the Practice in Hampton Roads**

In many ways, the Hampton Roads Region is one of the most advanced in the nation. It has:

- Created some of the first ITS plans in the nation — early deployment, master, major investment study and other plans,
- A leading metropolitan planning organization in terms of its commitment to ITS and to data collection to demonstrate costs and benefits,
- An active ITS Committee which has provided Regional leadership over the years,

- Installed over several years a sophisticated freeway management system with the Smart Traffic Center as hub,
- Planned or deployed state-of-the-art centrally controlled traffic signal systems with smart traffic centers, and
- A far-reaching plan through Hampton Roads Transit to initiate several projects to deploy a variety of ITS services.

Despite the Region's efforts, however, the Region faces significant challenges as noted earlier in Section 4.0. For example, some of the Region's problems have included:

- Procurement and contractor difficulties,
- Delayed and flawed project deployments,
- Resource reductions such as those for the Freeway Incident Response Team,
- Failures in deploying traveler information systems,
- Lack of trained staff to address sophisticated systems issues,
- Lack of champions at the senior policy level,
- Inadequate coordination between certain organizations, and
- Insufficient funding.

Some of these challenges are technical in nature and some are institutional. One fact is clear: Hampton Roads is not the only region facing similar challenges. This has given rise to much consideration and thinking at the national level on ways to address these challenges.

## **7.4 Next Steps for Hampton Roads**

### **7.4.1 Putting Ideas into Action**

In the *2000 COMPARE Update* contains many recommendations — especially ITS projects — similar to those in this plan. The Region has plenty of ideas but many have yet to be placed into practice or implementation. What may be lacking is:

- A clear and focused Regional vision as to how it will use ITS as part of a broader operations and management program,
- Regional goals and measurable objectives,
- An all-encompassing Regional implementation strategy,
- Adequate coordination at the Regional level between jurisdictions and agencies,
- Sufficient skills among the Region's workforce — both technical and administrative — to carry out technology projects, and
- Buy-in of the larger Regional "authorizing community".

While resources are often a chronic issue, where the vision is clear and sharp, resources will often follow. Therefore, the major challenge to the Region is to sharpen its focus and begin to be very clear about:

- Where it wants to go (Regional vision),
- What it will achieve on the way to attaining the vision (Regional goals and objectives),
- How it will get there (Regional implementation strategy),
- How players will play together (Regional concept of operations),
- How players will develop their skills (professional capacity building), and
- How to gain support from executives, legislators and the public (education and marketing).

The Region's ITS deployments are most meaningful as part of a larger regional effort to develop a full-fledged operations and management program. At this point, the Region – one of the most forward-thinking and advanced in the country – needs to seriously consider how it takes the next step to optimal functioning of its surface transportation systems on a daily basis.

#### **7.4.2 Viewing the System as a Whole**

One city traffic engineer noted during a forum for this project that the agencies and jurisdictions in the Hampton Roads Region have been sharing information but essentially acting independently in their ITS and operations and management activities. The time is coming, he said, when agencies and jurisdictions within the Region will need to integrate their activities to provide the best possible transportation system to the Region.

The long-range 2026 Plan also notes that one of the Region's top priorities should be "one inter-connected region." This can be interpreted in many ways including the following:

- Complete physical transportation network with no significant gaps,
- Multi-modal connections that enable cross-modal travel or traffic, and
- Complete transparency when it comes to sharing transportation-related information of importance to multiple agencies and jurisdictions.

It is this last thought to which the city traffic engineer was referring.

The nature of systems — whether a transportation network or an information technology system — is that they must be viewed in their entirety to be understood and properly utilized. The Hampton Roads Region is making progress in terms of viewing transportation from a systems perspective. However, the crosscutting nature of a transportation system (and subsystems) tends to cut across conventional decision-making. While this complicates the attainment of an overall perspective, it must not stand in the way of doing

so. Otherwise, end users — all travelers and other users of the transportation systems — suffer.

Another regional priority — as enunciated in the 2026 Plan — is to maintain the existing system. In addition to maintaining pavement, bridges, transit buses and other components of the transportation infrastructure, a focus on operations and management of the existing system is an important part of both maintaining — and effectively utilizing — the existing system and its capacity.

The underlying theme of this Strategic Plan is that Hampton Roads can improve its focus on efficiently and effectively operating and managing its transportation system. The recommendations in the next section address important elements necessary to sharpen this focus. As throughout this Plan, the presumption in what is proposed is that the perspective is regional, not local. However, aspects of what is proposed below can and should be adopted at the local level, i.e., by the single jurisdictions, as well.

## **7.5 *Moving to the Next Level of TSOM Development***

The table below highlights some key differences between regions that are in early stages of emphasizing operations and management versus regions that are more advanced. The first stage is referred to as the “activities” stage because that is where agencies and jurisdictions are undertaking operations and management-like activities, but they are not part of an integrated, performance-driven regional program. The “program” stage reflects a regional approach to an integrated program, which is consistently measured on its performance. The last column suggests strategies specific to Hampton Roads to move to the “program” stage.

**Table 7.4 Status of Operations and Management in a Region with Specific Hampton Roads Recommendations**

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Recognition of potential benefits of operations and management</b></p> <p>Level of understanding within the “authorizing community” (e.g., decision-makers, senior agency managers, key external constituents) of key features and potential benefits of a comprehensive operations and management program</p>	<ul style="list-style-type: none"> <li>• Limited understanding throughout region of concepts and potential benefits</li> <li>• No strongly expressed interest by policy and stakeholder community in operations and management</li> </ul>	<ul style="list-style-type: none"> <li>• Top management focus on specific operations and management goals and objectives</li> <li>• Executive and legislative support (as evidenced in funding or reporting requirements)</li> <li>• Some level of support and understanding from the public</li> </ul>	<ul style="list-style-type: none"> <li>• Reach “authorizing community” through: <ul style="list-style-type: none"> <li>◦ Education programs</li> <li>◦ Demonstration of benefits</li> <li>◦ Other marketing efforts</li> </ul> </li> <li>• Identify champions at the executive and legislative levels</li> </ul>	<ul style="list-style-type: none"> <li>• ITS Committee revamps existing marketing program using most recent performance data</li> <li>• ITS Committee allocates additional resources to education and marketing efforts</li> <li>• Marketing focus is on need to address non-recurring congestion through development of stronger operations and management program</li> <li>• ITS is treated as a tool in the operations and management toolkit, not a solution in and of itself</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Formal inclusion in policy</b> Statements and commitments in strategic and other policy documents that explicitly recognize the goals and measurable objectives associated with improving existing systems performance</p>	<ul style="list-style-type: none"> <li>• Limited references to/or treatment of improving operations as a priority in agency policies, strategic plans, etc.</li> <li>• No plan or commitment for setting regional goals and measurable objectives</li> </ul>	<ul style="list-style-type: none"> <li>• Systems operations and management is explicitly identified as agency responsibility</li> <li>• Commitment to a set of regional goals and measurable objectives</li> </ul>	<ul style="list-style-type: none"> <li>• Develop “draft” goals and measurable objectives</li> <li>• Include draft goals and measurable objectives in policies/plans for consideration/signoff by “authorizing community”</li> </ul>	<ul style="list-style-type: none"> <li>• Use the language in the 2026 Plan and this Strategic Plan to support a stronger emphasis on operations and management</li> <li>• Attach regional system-wide measurable objectives to the goals in the ITS Strategic Plan</li> <li>• Present these goals and measurable objectives to the Transportation Technical Committee, MPO and larger “authorizing community” to obtain their buy-in for making these part of regional policy</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Operations activities intensity</b> Degree of operations activities such as deployment of ITS, coverage of service patrol, frequency of signal retiming and incident quick clearance policies</p>	<ul style="list-style-type: none"> <li>Basic ITS infrastructure partially deployed with limited integration between agencies and jurisdictions</li> <li>Coordination is limited between highway and transit agencies</li> <li>Relationships with public safety agencies is business-as-usual with most coordination occurring between field personnel</li> <li>Limited interaction (and especially system integration) with non-highway/transit stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>Extensive ITS infrastructure with significant integration between agencies and jurisdictions</li> <li>Highway and transit have determined where operational coordination can accrue benefits to both and that coordination (including system integration) has occurred</li> <li>Extensive coordination with public safety agencies including automated data exchanges for incident detection and verification, etc.</li> <li>Coordination with other non-highway/transit stakeholders such as ports and military occurs and, where beneficial, systems are integrated</li> </ul>	<ul style="list-style-type: none"> <li>Develop operational agreements between agencies and jurisdictions where needed to help attain goals and objectives</li> <li>Plan for regional ITS deployments so as to achieve operational goals and objectives</li> <li>Plan/design ITS deployments in increments that return short-term value and payoff so as to show tangible benefits to “authorizing community”</li> </ul>	<ul style="list-style-type: none"> <li>Using the regional ITS architecture and this Strategic Plan as two of several tools, develop a more comprehensive regional concept of operations to clarify which jurisdictions and agencies will handle certain operations and management responsibilities</li> <li>Plan to, and integrate existing ITS deployments where operational improvements will accrue</li> <li>Build additional integrated ITS deployments around the regional concept of operations</li> <li>Develop operational agreements between the agencies requiring coordination as per the concept of operations</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Operations activities as a core program</b> Reflection of systems operations and management activities as identifiable program with specific strategies, management responsibilities and achievement targets</p>	<ul style="list-style-type: none"> <li>• Various operational activities undertaken, but responsibility fragmented</li> <li>• Not considered a “core program”</li> </ul>	<ul style="list-style-type: none"> <li>• Operations and management organized on a consolidated programmatic basis</li> <li>• Managed by higher-level manager(s) with responsibility and accountability</li> <li>• Dedicated and knowledgeable full time staff</li> </ul>	<ul style="list-style-type: none"> <li>• Consider ways of reorganizing operations and management components into a “regional” program</li> <li>• Consider some type of regional management/oversight</li> <li>• Consider some type of regional funding and/or shared resources</li> <li>• Consider development of staff and their capabilities and possibly shared use of staff</li> </ul>	<ul style="list-style-type: none"> <li>• ITS Committee inventories the existing operations and management components in the region to determine what a regional operations and management “program” might consist of</li> <li>• ITS Committee determines how that “program” might be described in regional-level documents</li> <li>• ITS Committee evaluates possible changes in operations management/oversight</li> <li>• ITS Committee looks for payoffs in resource sharing between agencies and jurisdictions</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Performance information</b> Use of measurable outcomes as focus of agency program with performance monitoring and measurement to insure progress</p>	<ul style="list-style-type: none"> <li>• Level of service information is not regularly collected</li> <li>• Operations activity information (e.g., incident clearance times, signal delay) is not collected, analyzed or reported</li> <li>• Performance targets or levels are not tracked</li> </ul>	<ul style="list-style-type: none"> <li>• Performance data is collected and utilized</li> <li>• Performance data is related to the regional goals and objectives</li> <li>• Performance data is reviewed against expected performance targets</li> <li>• Failure to reach targets results in evaluation and possible changes in program</li> </ul>	<ul style="list-style-type: none"> <li>• Develop regional performance measures directly relating to the regional goals and measurable objectives</li> <li>• Ensure the resources are provided to enable adequate performance data collection, synthesis and dissemination</li> <li>• Deploy the instrumentation necessary to capture performance data</li> <li>• Ensure skilled staff to collect, analyze and synthesize data</li> <li>• Match the performance data against expected performance targets to determine whether targets are being attained</li> <li>• Revamp programs (or, in some cases, change performance expectations) where performance is not matching expectations</li> </ul>	<ul style="list-style-type: none"> <li>• Using the recent ITS data inventory study, as well as HRPDC, UVA Smart Travel Lab and other data resources, determine what data is available/not available for developing performance measures</li> <li>• ITS Committee leads in developing feasible regional operations and management performance measures</li> <li>• ITS Committee works with Transportation Technical Committee to develop broad regional transportation performance measures</li> <li>• Committees present “draft” regional performance measures to “authorizing community” for review and acceptance</li> <li>• MPO committees identify resources for continuing performance measurement effort</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Organizational alignment</b> Degree of explicit responsibility and accountability for operations and management activities as consolidated, coordinated, identifiable program</p>	<ul style="list-style-type: none"> <li>Operations activities fragmented with different lines of reporting</li> <li>Operations activities managed as projects without being consolidated or coordinated in a coherent organization or program</li> </ul>	<ul style="list-style-type: none"> <li>Operations are coordinated through some type of regional coordinating body with some authority and accountability</li> <li>Operations and management projects are part of a larger organization or program</li> </ul>	<ul style="list-style-type: none"> <li>Create a regional Management and Operations Committee as part of the regional planning process</li> <li>Consider ways of gaining more explicit recognition for operations and management within regional decision making bodies, including more defined decision making processes for operations and management</li> <li>Recognize and create an operations and management program at the regional level in all planning and policy documents</li> </ul>	<ul style="list-style-type: none"> <li>ITS Committee identifies ways in which the region can better organize itself to take on a full-fledged regional operations and management program</li> <li>ITS Committee considers an expansion of its current role in management and operations vis-à-vis ITS alone</li> <li>ITS Committee considers a way in which decision making on “regional” operations and management and ITS programs can be better defined and become more regional in nature</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Regional program consistency</b> Recognition of need for both regional tailoring and statewide and local consistency</p>	<ul style="list-style-type: none"> <li>• Jurisdictions/agencies pursue own programs</li> <li>• Interoperability and other consistent approaches are not highly valued</li> <li>• No consistency with other local, regional or state-wide programs</li> </ul>	<ul style="list-style-type: none"> <li>• Regional policy on operations and management exists</li> <li>• Local jurisdictions and agencies develop individual strategies consistent with the regional and statewide policy/program</li> </ul>	<ul style="list-style-type: none"> <li>• Establish specific regional policy on operations and management</li> <li>• Local jurisdictions develop policies consistent with the regional policy</li> <li>• The regional policy is coordinated for consistency with state-level policy</li> </ul>	<ul style="list-style-type: none"> <li>• ITS Committee sets specific expectations with regard to consistency between local, regional and state programs</li> <li>• While respecting local autonomy, ITS Committee or other regional body takes on larger role in setting policy on cross-cutting regional projects</li> <li>• ITS Committee sets specific interoperability requirements between certain types of deployments where regional connectivity is crucial</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Dedicated resource allocation</b> Provision of staff capability and financial (especially operating) resources to sustain a continuing commitment</p>	<ul style="list-style-type: none"> <li>Little management knowledge of resources utilized by operations (other than snow and ice, service patrol and support to some major ITS deployments)</li> <li>Many operations and management activities not separately budgeted</li> </ul>	<ul style="list-style-type: none"> <li>Operations and management as identifiable program</li> <li>Line-item budget for activities at regional level</li> <li>Possibility of shared resources, e.g., skilled personnel, funding, across region</li> </ul>	<ul style="list-style-type: none"> <li>Convince “authorizing community” of benefits of identifiable operations and management resources</li> <li>Identify various activities and budgets across the region that are operations and management in nature</li> <li>Identify opportunities for sharing resources</li> </ul>	<ul style="list-style-type: none"> <li>ITS Committee develops inventory of existing regional operations and management activities and related budgets</li> <li>ITS Committee determines ability to aggregate budgets into a regional total to enable assessment and comparison to other expenditures, e.g., new construction</li> <li>ITS Committee identifies cross-cutting needs that may not be met, e.g., signal timing, joint procurements of ITS equipment, and determines what steps might be taken regionally to meet those needs</li> <li>ITS Committee recommends to the “authorizing community” that dedicated resources be established</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Interagency stakeholder operational cooperation</b> Relationships among service providers regarding program alignment, roles and relationships and specific coordination and training for operational activities</p>	<ul style="list-style-type: none"> <li>Agencies and jurisdiction have separate and uncoordinated programs</li> <li>Jurisdictions meet and share information</li> </ul>	<ul style="list-style-type: none"> <li>Shared concepts of operations</li> <li>Collocation exists where appropriate</li> <li>Resources are shared where appropriate</li> <li>Shared regional training and coordination activities to help ensure region-wide consistency</li> </ul>	<ul style="list-style-type: none"> <li>Develop regional concept of operations</li> <li>Determine where coordination is essential</li> <li>Develop memoranda of understanding where appropriate</li> <li>Determine where and how resources may be shared</li> </ul>	<ul style="list-style-type: none"> <li>ITS Committee develops more detailed concept of operations</li> <li>Using concept of operations, ITS Committee identifies cross-cutting areas where coordination is essential between agencies and jurisdictions, e.g., project planning and design, training</li> <li>ITS Committee identifies ways in which necessary regional coordination between agencies and jurisdictions is achieved such as through memoranda of understanding</li> </ul>

Indicators	“Activities” Stage	“Program” Stage	Strategy For Moving To “Program” Stage	Specific Recommendations
<p><b>Incorporation of ITS and Operations in TIP and other Regional Plans</b></p> <p>Develop “level playing field” planning and programming process that accommodates relevant operations and management strategies, time frames and performance measures on a par with capital improvements</p>	<ul style="list-style-type: none"> <li>Operations and management investments/activities are handled off-line as ITS, transportation systems management (TSM) or travel demand management (TDM) plans using, e.g., CMAQ and STP funds</li> <li>Such activities are not integrated into formal long-range deficiency analysis and investment options evaluation</li> </ul>	<ul style="list-style-type: none"> <li>Operations and management is an integral part of the capital program</li> <li>Operations and management is an identifiable category</li> <li>All elements of the transportation plans and programs – capital, and operations and management – are measured and compared for their investment returns so as to improve outcomes for transportation system users</li> </ul>	<ul style="list-style-type: none"> <li>Incorporate operations and management fully into the overall transportation plan and program</li> <li>Recognize the somewhat different nature of operations and management versus traditional capital programs, e.g., typically lower cost versus higher cost, typically quicker to implement versus longer to implement</li> <li>Put in place the ability to measure the benefits and costs of all elements of the transportation plan and program</li> </ul>	<ul style="list-style-type: none"> <li>ITS Committee better defines the operations and management component of the regional transportation plan and program</li> <li>ITS Committee works with the Transportation Technical Committee and the “authorizing community” to put in place the mechanisms for determining benefits and costs of all elements of the transportation plan and program as well as specific system performance measures</li> </ul>

## **7.6 Effect of Implementation Strategies on ITS Committee**

The ITS Committee, under the mantle of the HRPDC, has served effectively to help coordinate the activities of VDOT and the cities in their efforts to introduce to the Region. Now, to obtain the most return for the Region's citizens, additional data and information exchange is vital, meaning much more extensive integration — both in a technical and non-technical sense — than has occurred to date. In order to effect more extensive integration, the Region's jurisdictions and agencies will need to make decisions, which will more profoundly impact each other.

In Section 7.5 above, a number of strategies are outlined along with recommendations. Most of these recommendations are directed to the ITS Committee. None of these recommendations are trivial, and all will require time and other resources. This leads to the question as to whether the ITS Committee — with its current structure and resources — can effectively take on additional assignments and duties.

Essentially, this Plan advocates a three-pronged approach to ITS and enhanced operations and management in the Hampton Roads Region:

- Implement quick fixes identified through the Strategic Plan working group sessions as soon as possible,
- Plan for, and implement, a phased set of ITS projects under six program areas over a much longer period of time, and
- Change the institutional parameters within which the transportation community works so that more emphasis is placed on transportation system operations and management.

If the ITS Committee adopts this ambitious three-pronged approach, it needs to position itself to implement the approach. Some suggestions for doing this include:

- Develop a clear plan of action with milestones based on the recommendations in this Plan,
- Given the number of recommendations on strategic direction in this Plan, utilize a facilitated discussion to work through the several recommendations and prioritize them,
- Begin a process of developing and establishing measurable operations and management objectives for the Region,
- With regard to the ITS projects, establish six long-term subcommittees that mirror the six program areas,

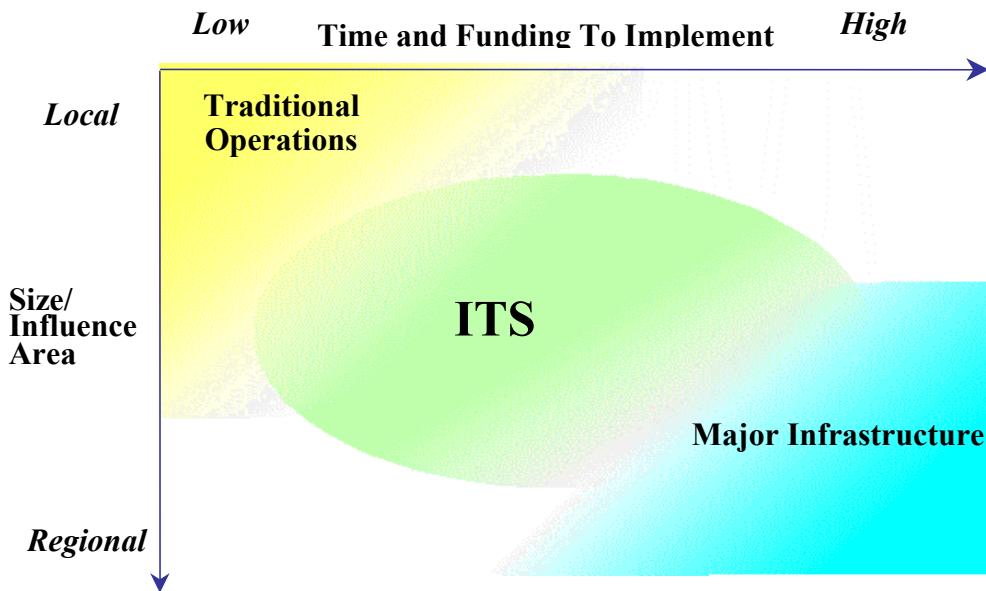
- Decide on whether the quick fixes should be done and then set up task forces of the ITS Committee to ensure they happen or place responsibility for the quick fixes under the appropriate six program area subcommittees,
- With regard to the institutional and non-technical challenges, establish a subcommittee to determine what steps should be taken to move towards an enhanced operations and management focus,
- Meet on a monthly or more regular basis,
- Rely on the subcommittee structure to enable additional consideration of the issues,
- To supplement Committee efforts, add persons who do not sit on the ITS Committee to serve on the subcommittees, e.g., other technical staff from VDOT, the cities, other non-transportation agencies,
- Determine whether there are other venues through which the recommendations might be better achieved, e.g., the Transportation Technical Committee, and influence leaders in those other venues to take action on the recommendations,
- Add additional staff support for the ITS Committee through HRPDC or otherwise, and
- Consider involving senior-level policymakers in the Committee's makeup or, as in other areas, recommend that a high-level body of the MPO be established to oversee operations and management and to assist in working through some of the regional policy issues that hinder both institutional and systems integration.

A clear implication of the above is that the ITS Committee must become more of a decision-making body rather than a coordinating or information-passing organization. While the ITS Committee can often not act on its own, it can decide to more frequently forward recommendations for action to the Region's policymakers who serve on the MPO. Moreover, the ITS Committee — while still composed of independently autonomous jurisdictions and agencies — must think and act regionally while enabling those independent jurisdictions and agencies to receive their fair share of benefits from ITS projects and other operations and management initiatives.

In the short term, continued reliance on the ITS Committee makes sense. Over the longer term, consideration might be given to other types of management structures. In some cases, new organizations are created to establish a regional cooperative approach and to improve interagency cooperation. The Transportation Operations Coordinating Committee, or TRANSCOM, in the New York/New Jersey/Connecticut area is an example. In other locales, the MPO has played a more active role in operations, with the Metropolitan Transportation Commission in the San Francisco Bay area being the prime example. These or other models may be considered if the ITS Committee believes a need exists for a different type of regional structure.

## 7.7 Planning and Performance Measure Considerations

As noted previously, planning for ITS systems is different from traditional capital and operations planning. Typically, the former is handled in longer-range plans while operations planning may be reflected in annual agency budgets. ITS systems tend to fall somewhere in between. Traditional operations and ITS — combined into a management and operations program — can effectively range from local to regional and short to long-term in terms of its influence and time span respectively. The following figure reflects more traditional notions:



**Figure 7.1 Planning for Different Project Types<sup>13</sup>**

Recognition of the above differences is important. Traditional planning processes need to be sufficiently flexible to include ITS planning. In this regard, Hampton Roads has been as advanced as any other metropolitan area. Nonetheless, this Region — as with others — does not have meaningful measures by which to compare the return on investment of different types of transportation improvements. Again, as noted above, the importance of regional transportation goals and objectives — with performance data to measure those objectives — is a critical piece to improving transportation for the users of the Hampton Roads transportation system. This critical piece is also important in helping to define regional planning needs.

As noted previously, Hampton Roads data is used in national studies of metropolitan areas such as the TTI study. For example, measures in the TTI study include Annual Delay and Annual Excess Wasted Fuel. HRPDC and other regional agencies produce their own reports and analysis on topics such as travel time, congestion, accidents and other

<sup>13</sup> The above figure is based on a figure from "Incorporating ITS into the Transportation Planning Process," guidance prepared under the National Cooperative Highway Research Program (NCHRP) Project 8-35.

transportation-related subjects. These studies point to areas in which improvements can be made.

Operational agencies such as VDOT also collect data on such measures as freeway incident detection clearance time. With its bus automatic vehicle location system in place, HRT will also collect extensive amounts of performance-related data. In short, there is a wealth of data to support at least certain performance measures. Possible goals — established at a regional level — might include setting the average time in minutes to detect an incident on a freeway or reducing the percentage of buses more than x minutes behind schedule. Agencies fulfilling similar missions should coordinate in the collection and organization of data such that region-wide performance perspectives can be obtained.

Such performance data and related measures are valuable in showing opportunities, problem areas and trends. Where this data is also tied to regional goals and objectives, it can be used to benchmark whether the Region is attaining the progress it seeks. Where benchmarks are not being met, new initiatives can be considered to meet those benchmarks.

The Hampton Roads Region would benefit from a set of goals and measurable objectives tied to existing data. This type of initiative — with a focus on operations and management — could originate with the ITS Committee. At the Transportation Technical Committee level, such measures could be combined with other relevant transportation system measures to provide a full set of regional goals and objectives against which the Region can benchmark its progress. While setting goals and objectives can be difficult, and competing views will ultimately need to be resolved at the policymaking level, benefits will ultimately accrue to the Region.

## **7.8 Deployment Considerations**

### **7.8.1 General Approach**

The Region has deployed a number of systems and is in the process of deploying more. Frustration exists with regard to the deployment difficulties as well as lack of expected benefits from some of these projects. In some instances, some deployments may offer the possibility of additional benefits. The Region should look closely at its existing deployments to ensure they may not provide additional — as yet unrecognized — benefits that may be achieved through modest efforts.

In general, some considerations for deployment of regional ITS projects include ensuring:

- The ITS project is structured or phased so as to provide early benefits (as well as early indications as to whether the project will deliver on its promise),
- The ITS project fits within the broad-based regional concept of operations and the regional ITS architecture as well as within other regional plans,
- The project, to the extent feasible and necessary, uses standards and protocols that will enable interoperability with other regional entities and equipment, and

- The appropriate systems engineering planning for a given deployment has been done, to include:
  - A system-specific concept of operations
  - Adequately defined requirements
  - Adequately defined design
  - System, hardware and software test regimens

With regard to procurement issues, the Region has learned with great pain that the current procurement processes are not ideal for deploying ITS. At the statewide level, the Region has been working with VDOT to resolve these issues, an effort which should continue. Other considerations include structuring the procurement such that:

- Public procurement officials understand the different requirements of systems projects versus other types of transportation projects and demonstrate a willingness to reflect those different requirements in procurement documents (Note: Program managers may need to take the time to educate their counterpart procurement officials.),
- Accountability and responsibility are clearly assigned – both on the public and private side,
- Contractor milestones occur often enough so that project progress and contractor performance can be assessed on a recurring and regular basis,
- Contractor payments are tied to feasible milestones so contractors are not left unpaid despite solid performance,
- Contractor payments are tied to actual attainment (tested where applicable) of milestones,
- The selection criteria, and the financial and/or risk structure of the contract, allow for the acquisition of the best qualified and most appropriate type of contractor, and
- There are built-in incentives for both the public and private participants to work together and benefit from the project.

In terms of managing these projects, issues have arisen in the past because of the way in which VDOT has managed projects for the cities. Part of this may have to do with existing VDOT procurement and contracting rules. Part may also have to do with a split in responsibilities between the public agencies, so accountability cannot be clearly assigned. In general, program or project managers on the public side need to ensure they:

- Have access to the technical resources necessary to effectively manage a project which sometimes means hiring additional technical support to oversee and inspect the contractor's work,

- Have regular and effective communications with the contractor and other public agencies that may be involved for support or as the actual end user,
- Have mechanisms in place for identifying and resolving divergences from plans, budgets, schedules, etc., and
- Provide sufficient oversight over contractor products and services including having an agreed-upon regimen for testing.

In relationship to performance measures discussed above, the notion of a regional dashboard for ITS projects may be one way to publicly display progress on key regional projects, not only for VDOT's projects but also for other regional or local projects. Accountability for performance could be placed on a regional manager(s) or body (such as the MPO or ITS Committee) as well as on the program/project managers.

In some cases, deployment might be better delayed if the precursor steps above have not been performed or cannot be guaranteed.

## **7.8.2 Standards and Interoperability**

This Plan emphasizes the need for transparent data and information exchange between those jurisdictions and agencies operating and managing the transportation system and, for some types of data and information, exchange with non-surface transportation agencies such as the military. Often, such transparent and automated exchanges are dependent on equipment that can "talk" to each other. In turn, the ability to talk may rest on common standards and protocols.

At the VDOT level, this might mean systems that can exchange data between the STC and the VDOT bridge/tunnel control centers. At the local level, this can mean exchange of data on traffic levels on principal arterials between jurisdictions as well as information on traffic signal timings. Information on bridge raisings could be exchanged between VDOT and one or more cities. In addition, VDOT and one or more cities could coordinate principal arterial and freeway information to enable enhanced traffic management.

Increasingly, transportation agencies are finding it useful to exchange data with law enforcement agencies because the latter often learn of highway or related incidents before transportation agencies. Linking of police computer-aided dispatch and transportation management centers is proceeding in many different regions. In emergencies, especially those requiring evacuations, rapid exchange of data and information between transportation and emergency response agencies can be critical. In short, more automated exchange of information and data can make for a much improved transportation system.

To accrue the benefits noted above, systems and the underlying equipment must be designed according to standards that enable interoperability. The USDOT on, its standards web page (<http://www.standards.its.dot.gov/standards.htm>) provides the following table, which shows the National ITS Architecture Interface Class and Standard Application Areas:

**Table 7.5 National ITS Architecture Interface Class and Standard Application Areas**

National ITS Architecture Interface Class	Standards Application Areas
<b>Center-to-Roadside</b> – This category of application areas includes those standards that provide communication links between a transportation or traffic management center and roadside equipment that regulates the flow of traffic.	Data Collection and Monitoring Dynamic Message Signing Environmental Monitoring Ramp Metering Traffic Signaling Vehicle Sensing Video Surveillance
<b>Center-to-Center</b> – This category of application areas includes those standards that facilitate communication between transportation management centers. This category includes communications necessary for transit use.	Data Archival Incident Management Rail Coordination Traffic Management Transit Management Traveler Information
<b>Center-to-Vehicle/Traveler</b> – This category of application areas includes those standards that facilitate communication between transportation management centers and the driver of a vehicle or a traveler planning a trip. This category also includes communications necessary for coordination between transit management centers and their vehicles.	Mayday/Site Surveillance Transit Vehicle Communications Traveler Information
<b>Roadside-to-Vehicle</b> – This category of application areas includes those standards that facilitate wireless communication between roadside equipment and vehicles on the road.	Toll/Fee Collection Signal Priority
<b>Roadside-to-Roadside</b> – This application area category includes standards that facilitate communications between railroad wayside equipment and highway roadside equipment.	Highway Rail Intersection (HRI)

What is immediately apparent from this table is that Hampton Roads has already invested in ITS systems and equipment that fall within the areas where existing and developing standards can be applied. In order to ensure future interoperability, the Region — in particular the ITS Committee — needs to consider application of these standards across the Region.

The Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) states in Section 5205(a)(2)(c), that the primary goal of ITS Standards Program is *“to promote and ensure interoperability in the implementation of intelligent transportation system technologies, including actions to establish critical standards.”* TEA-21 required the USDOT to identify which ITS standards are critical. The USDOT has identified 17 standards that are critical to ensuring national ITS interoperability or critical to the development of other standards. These standards are:

1. Advanced Traveler Information System (ATIS) Data Dictionary – Enables traveler information service providers, such as traffic reporters and police, with conforming products to provide travel information to mobile users, including the general public, nationally.
2. ATIS Message Set – Enables service providers, with conforming products, to provide travel information to mobile users nationally.
3. Advanced Traffic Management (ATMS) Data Dictionary (TMDD) – Used by traveler information systems that provide services to mobile users nationally, such as information about roadway conditions, and by traffic management systems that collect, interpret, and present traffic management information.
4. Commercial Vehicle Credentials – Enables commercial carriers, such as large trucks and interstate buses, to communicate with and transmit required information to state transportation agencies and relevant state and national databases electronically.
5. Commercial Vehicle Safety and Credential Information Exchange – Enables commercial carriers to communicate with and transmit required information to state transportation agencies and relevant state and national databases electronically.
6. Commercial Vehicle Safety Reports – Enables commercial carriers to communicate with and transmit required information to state transportation agencies and relevant state and national databases electronically.
7. High Speed FM Subcarrier Waveform Standard – Allows traveler information messages to be broadcast to travelers nationally.
8. Information Service Provider-Vehicle Location Referencing Standard – Assures consistency in location referencing and uniform processing for mobile users nationally; used in other standards that specify location information.
9. Message Sets for Dedicated Short Range Communications (DSRC), Electronic Toll and Traffic Management (ETTM) and Commercial Vehicle Operations (CVO) – Provides content and order of information transmitted in messages for various ITS user services, such as electronic toll, traffic management, and commercial vehicle operations.
10. On-board Land Vehicle Mayday Reporting Interface – Provides for the transmission of messages and information between emergency management centers and mobile users nationally.
11. Standard for Common Incident Management Message Sets for Use by Emergency Management Centers – Allows incident management messages to be shared among different ITS systems and entities and assures consistency of incident management messages.

12. Standard for Data Dictionaries for Intelligent Transportation Systems – Establishes the requirements for the attributes to be used by all ITS data dictionary standards to assure unambiguous information transfer.
13. Standard for Message Set Template for ITS – Standardizes the structure for messages used in all ITS standards.
14. Standard Specification on DSRC–Data Link Layer – Allows for short-range communications between roadside equipment and vehicles nationally.
15. Standard Specification on DSRC-Physical Layer – Allows for short-range communications between roadside equipment and vehicles nationally.
16. Standard Specification on DSRC at 5.89 GHz – Allows for short-range communications between roadside equipment and vehicles nationally.
17. Standards for ATIS Message Sets Delivered Over Bandwidth Restricted Media – Allows mobile users with conforming products to access traveler information services nationally.

The Architecture Consistency Guidance requires agencies to adopt critical standards as they are developed. Implementing agencies in the Hampton Roads region should monitor the activity of these standard development efforts. When developing or purchasing new ITS equipment, agencies will need to determine if one or more of the standards needs to be applied to achieve the level of interoperability desired. In general, ITS implementers are encouraged to use these standards where applicable in developing, designing, and procuring ITS components and systems.

### **7.8.3 Operations and Maintenance**

A critical factor in developing a successful ITS program is a strong commitment to efficiently operate and maintain the field devices, system components, communications network, and software that are deployed. The funding classifications included as part of ITS maintenance are commonly debated. One example is whether capital spending for replacing and upgrading malfunctioning or outdated system components should be categorized as a maintenance function. It is important to note that, given the continuing advances in technology, systems and their components will need to be replaced to obtain enhanced functionalities.

Often, the following expenditures are included in the system operations and maintenance cost estimates:

- Management staff hours — Full-time labor to manage day-to-day program activities/initiatives, contracts, in-house planning and technical studies, operational/maintenance staff, public outreach, training, coordination with other agencies, and general program decision-making

- Operational staff hours — Full/part-time and on-call labor to control, configure, provide security, administer, and troubleshoot systems/software/communications electronics and hardware; undergo training; provide patrolling and incident management services along highways; perform other administrative program/office functions
- Maintenance staff hours — Full/part-time and on-call labor or contracted labor to troubleshoot, repair, run diagnostics on, and generally perform upkeep on field devices and system components
- Operational expenses — Costs related to day-to-day running of facilities and systems, including building use costs, monthly phone and power, and leased communication lines
- Maintenance expenses/equipment — Costs to supply spare parts, vehicles, equipment, and tools needed to repair field devices and systems components
- Software fixes (as opposed to significant enhancements in software functionality)

Determining reliable O&M figures can be difficult, given the diversity of systems and operating environments. Fifteen percent per year is sometimes used as a rule-of-thumb for overall system operations and maintenance although items such as software fixes could be somewhat lower. In planning projects and assigning costs, considering the O&M life-cycle cost is important; otherwise, as agencies with ITS and related systems have found, resources may be unavailable to effectively operate or maintain those systems.

#### **7.8.4 Staffing and Training**

Adequate numbers of personnel with appropriate training is important to a successful regional operations and management program. In addition to determining the capital and O&M costs of a project or a system, it is also useful to estimate how many staff will be required to support it. Just as with systems that go unrepaired due to lack of O&M funding, TMC's that go unstaffed can be just as useless. Staff skill levels are also important.

Agencies might consider special programs or internships to lure particularly skilled individuals to work for them. Providing educational assistance to employees can also be beneficial. Several certification programs exist, e.g., Professional Traffic Operations Engineer, to ensure certificate holders have a guaranteed level of technical knowledge commensurate with their positions. Such certification classes occur routinely in the Hampton Roads Region or nearby.

In addition to attracting skilled personnel to transportation positions, on-going training or professional capacity building of existing personnel is also vital. One might view three levels:

1. Awareness training to acquaint personnel with operations and management and ITS
2. Tailored management training to acquaint program/project managers or procurement officials with the requisite level of knowledge to manage a procurement, project, system or contract
3. Specialized training in specific technical skills

Managers might consider what level of training individual employees need and ensure they have it. A wise investment in education or training can save many dollars on a project through enhanced understanding and better oversight.

Many capacity building resources exist. The ITS Peer-to-Peer Network, funded by USDOT, has been used to bring peer knowledge to the Region on topics such as managing a city's central traffic signal system. FHWA courses have been provided on subjects such as systems engineering. The Consortium for ITS Training and Education offers on-line courses. While not always fulfilling every need, these resources can often be made available at little or no cost.

Regional forums also help to boost the awareness and understanding levels. The ITS Committee itself — through the informational presentations made there — is an educational forum. Fortunately, the Hampton Roads area also attracts state and sometimes national transportation conferences from groups such as the Intelligent Transportation Society of Virginia, the Virginia Section of the Institute of Transportation Engineers, the Transportation Research Board Freeway Operations Committee and the American Association of State Highway and Transportation Officials.

The Region needs to continue to leverage its education and training dollars, and to take advantage of existing resources, to ensure it has a sufficiently sized and skilled workforce to meet the increased expectations in an increasingly high-tech work environment. In fact, this Plan calls on the Region to make a stronger and larger commitment to ITS and transportation system operations and management. Following through on this commitment will be difficult without additional staffing, as moving forward will require more staff for planning, implementation, and continuing operations. The Region needs to carefully assess its needs in this area and take steps to fulfill those needs.

## **APPENDICES**



## APPENDIX A: List of Acronyms

ACS	Advanced Communication System
ADMS	Archived Data Management System
APC	Automatic Passenger Counter
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automatic Vehicle Location
CAD	Computer-Aided Dispatch
CBBT	Chesapeake Bay Bridge-Tunnel
CMS	Changeable Message Sign
CCTV	Closed Circuit Television
CVO	Commercial Vehicle Operations
DERT	Downtown Elizabeth River Tunnel
DVMT	Daily Vehicle Miles of Travel
EMS	Emergency Medical Services
EOC	Emergency Operations Center
ERP	Enterprise Resource Planning
ETIS	Evacuation Traffic Information System
FHWA	Federal Highway Administration
FIRT	Freeway Incident Response Team
FTA	Federal Transit Administration
GPRS	General Packet Radio Service
HAR	Highway Advisory Radio
HRBT	Hampton Roads Bridge-Tunnel
HRPDC	Hampton Roads Planning District Commission
HRI	Highway Rail Intersection
HRT	Hampton Roads Transit
ISP	Information Service Provider
IVR	Interactive Voice Response
ITS	Intelligent Transportation System
LOS	Level of Service
MDT	Mobile Data Terminal
MERT	Midtown Elizabeth River Tunnel
MMBT	Monitor Merrimac Memorial Bridge-Tunnel
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statistical Area
NIT	Norfolk International Terminal
NNS	Norfolk Naval Station
O&M	Operations and Maintenance
OSAM	On-Street Arterial Master
PMT	Portsmouth Marine Terminal
PDA	Personal Digital Assistant
POC	Point of Contact
R&D	Research and Development
RIS	Roadway Information System
RMMS	Regional Multimodal Management System

RWIS	Road Weather Information System
STC	Smart Traffic Center
TDM	Travel Demand Management
TEOC	Transportation Emergency Operations Center
TIES	Transit Information Enterprise System
TMC	Transportation Management Center
TMS	Traffic Management System
TOC	Traffic Operations Center
TSM	Transportation Systems Management
TSOM	Transportation System Operations and Management
TSP	Traffic Signal Preemption
TTI	Texas Transportation Institute
USCG	United States Coast Guard
VDEM	Virginia Department of Emergency Management
VDOT	Virginia Department of Transportation
VES	Video Enforcement System
VPA	Virginia Port Authority
VSP	Virginia State Police
WAT	Williamsburg Area Transport

## APPENDIX B: Hampton Roads ITS Projects Inventory

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Graphic Traffic Information System	Traffic management.	Operational	- Computer hardware/software - communications	Operational	\$50,000	The central system fuses surveillance data from the bridge/tunnel traffic management systems.  Color-coded graphic display of link traffic speeds in/on the Hampton Roads Bridge-Tunnel, Monitor-Merrimac Memorial Bridge-Tunnel, and the Elizabeth River Downtown Tunnel.
Hampton Roads Traffic Management System (TMS) Phase 1	Freeway monitoring, traffic information dissemination and communications backbone.	Operational	- Smart Traffic Center - 38 CCTV cameras - 640 embedded loop detectors - 147 piezoelectric sensors - 25 CMS signs (plus 39 CMS signs prior to Phase 1) - 99 miles of fiber optic cables (19 roadway miles)	Completed 1996	\$15,000,000	Some CMS signs deployed along arterial streets in the vicinity of freeway interchanges.
Highway Advisory Radio (HAR)	Traffic information dissemination.	Under development (project award 04/03)	- HAR equipment/transmitters - added 4 new sites in the region.	December-03	\$250,000	Uses super efficient antenna technology; two sites; 610 AM broadcast; replaced older HAR system of six transmitter sites.
# 77 Cellular Call-in Program	Incident detection via motorist cellular call-ins.	Operational	- Static signage	Operational statewide	Unknown	The system is operated by the Virginia State Police with assistance from VDOT.
*Hampton Roads TMS Phase 2	Freeway monitoring, traffic information dissemination and communications backbone.	Operational	- 80 CCTV cameras - 61 embedded loop detectors - 14 piezoelectric sensors - 196 side radar fired - 87 CMS signs - 149 miles of fiber optic cables (31 roadway miles covered)	March-04	\$38,000,000	Traffic cameras on I-64, I-264, I-564, and I-664

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## VDOT Hampton Roads STC ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
*Hampton Roads TMS Phase 3	Freeway monitoring, traffic information dissemination and communications backbone (63 miles).	55% complete	- 170 CCTV cameras - 908 embedded loop detectors - 18 piezoelectric sensors - 348 acoustic sensors - 93 CMS signs - 304 miles of fiber optic cables (63 roadway miles covered)	October-05	\$60,000,000	Conduit installation underway on I-264, I-464, and on I-664 on the Peninsula.
*TMS Integration and Software Development	Integration and information processing (software for integrating and automating the TMS), incident detection.	60% complete	- Computer hardware/software	December-05	\$12,000,000	Initial integration package (camera and CMS control) has been used by STC traffic controllers since 9/1/01. Testing of the core traffic management system, incident response, CCTV cameras, and CMS are complete.
Roadway Information System (RIS)	Regional communications system for the exchange of transportation information (data and video) among the region's transportation agencies.	Operational	- Computer hardware/software - communications	Operational statewide	\$260,000	Operational, but currently not completely utilized.
Regional Multimodal Management System (RMMS)	Information processing and storage (a clearinghouse of regional transportation data).	Under development	- Computer hardware/software (database and data processor) - communications	October-05		Cost is part of TMS Integration and Software Development project (Phase 3 Project). Project is under consideration. Part of Phase 3 is to address the operational data requirements and incident management parameters that the system could support.
Automated Maintenance Management System	Automates the record keeping of inventory and maintenance of equipment for the TMS.	Operational	- Computer hardware/software	Operational		Off-the-shelf software has been selected for evaluation and suitability.
*Advanced Traveler Information Systems (ATIS)	Traveler information via multiple devices/methods.	Under development (rolled into regional 511 efforts and regional video distribution project)	- Interactive kiosks - telephone interactive voice response system (IVR) system (toll-free) - CCTV footage to television stations	June-05	\$1,000,000	The ATIS will be a public-private partnership. VDOT currently provides local TV stations with CCTV footage.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## VDOT Hampton Roads STC ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Reversible Roadway Gate Control	Operational as part of the TMS systems integration project.	Operational	- Gate control equipment	Operational		
Video and Data Sharing Project	Share video and traffic management related data with jurisdictional STC's via fiber backbone connection.	Under development	- Fiber / backbone touch points (VDOT)- hardware/software needed to receive/exchange video with STC (cities)- conduit to touch points from cities, junction boxes at touch points, splice cabinets, interconnect cables, and fiber-optic cables (cities)	On-going deployment (under Phase 3)		Each city may connect to the TMS at a designated location with the City limits. Cities must coordinate connection with VDOT. Cities will be allowed to connect to up to 8 dedicated single mode fibers. Cities will be responsible for performing all work necessary to make the connection from the City's video switch to the VDOT fiber drop.
Route Diversion Plan	Traffic management, incident and emergency management.	Operational	- Region-wide planning effort	Completed		
DynaMIT Traffic Condition Prediction Project	Traffic management.	Planned	- Condition prediction software predicated on archived traffic data vs. real time traffic data	Completion expected in 2004		Co-UVA/MIT/VDOT project.
Archived Data Management System Project	Traffic management.	Under development	- Archived data from TMS	Under development	TBD	FHWA sponsored project.  Data repository located at UVA.
VDOT / VSP CAD-TMS Interface	Incident and emergency management.	Potential	- Integration software	TBD	TBD	This potential project was articulated by both VSP and VDOT.
Equipment Sharing with Norfolk Naval Shipyard (NNS)	Traffic management.	Under development	- Portable CMS - information dissemination equipment	On-going		VDOT and NNS have been communicating and are sharing equipment
Ramp Metering	Freeway traffic control.	Potential	- Ramp meter equipment	TBD	TBD	

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## VDOT Tunnel Traffic Control Systems Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Midtown Tunnel CCTV System	Traffic monitoring.	Operational / enhancements under development	- CCTV - systems integration	December-05	\$3,000,000	Part of the Pinner's Point Project.  Systems integration RFP under evaluation (Fall 2003).
Hampton Roads Bridge-Tunnel Traffic Control and Surveillance System	Traffic control, traffic surveillance, incident detection, traffic information dissemination.	Operational	- Over height vehicle detectors - variable speed limit signs - traffic signals / lane control signs - CCTV - loop detectors - CMS - computer hardware/software	Operational	\$1,000,000	The tunnel traffic control system will provide the following data to the Smart Traffic Center: occupancy, speed, volume, CCTV footage, CMS status, and lane control status.
Monitor Merrimac Memorial Bridge-Tunnel Traffic Control and Surveillance System	Traffic control, traffic surveillance, incident detection software, traffic information dissemination.	Operational	- Variable speed limit signs - CCTV - loop detectors - CMS - computer hardware/software	Operational	\$1 million for upgrades	The tunnel traffic control system will provide the following data to the Smart Traffic Center: occupancy, speed, volume, CCTV footage, and CMS status.
Downtown Tunnel Traffic Control and Surveillance Systems	Traffic control, traffic surveillance, incident detection software, traffic information dissemination.	Operational	- CCTV - loop detectors - CMS - computer hardware/software	Operational	\$1 million for upgrades	The tunnel traffic control system will provide the following data to the Smart Traffic Center: occupancy, speed, volume, CCTV footage, and CMS status.
Pinner's Point / Midtown Tunnel Traffic Control and Surveillance Systems	Traffic control, traffic surveillance, incident detection software, traffic information dissemination.	Part of the Pinner's Point Project.  Systems integration RFP under evaluation (Fall 2003).	- Over height vehicle detectors - CCTV - loop detectors - CMS - computer hardware/software	RFP under evaluation		The Midtown Tunnel currently has a CCTV system. The project will add a PC-based central computer system and software that is platform consistent with the TMS software. It will also add over height vehicle detectors, CCTV cameras at the Pinner's Point interchange, loop detectors, CMS, and fiber optic cables for telemetry-to-field communications.  The tunnel traffic control system will provide the following data to the Smart Traffic Center: occupancy, speed, volume, CCTV footage, and CMS status.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test  
Under Development: projects that are procured (under contract) or being installed/constructed  
Operational: projects that have passed final inspection and are functioning  
N/A: not applicable

## VDOT Hampton Roads Other ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
VDOT, INFOLINE, and ONE LINE Telephone Systems	Traffic information via the telephone.	<ul style="list-style-type: none"> <li>- Operational for tunnels</li> <li>- will be part of regional 511 effort</li> </ul>	<ul style="list-style-type: none"> <li>- Telephone IVR system (local)</li> </ul>	Part of regional 511 effort		<p>Provide current traffic information in/on the Hampton Roads Bridge-Tunnel, Monitor Merrimac Memorial Bridge-Tunnel, Midtown Tunnel, Coleman Bridge, and James River Bridge.</p> <p>Each VDOT facility operator is responsible for providing and updating traffic information pertaining to its facility. INFOLINE is operated by The Virginian Pilot, and ONE LINE is operated by The Daily Press.</p>
Coleman Bridge Smart Tag	Electronic toll collection.	Operational	<ul style="list-style-type: none"> <li>- Vehicle transponder (tag)</li> <li>- roadside reader unit</li> <li>- video enforcement system (VES)</li> <li>- computer hardware/software</li> </ul>	N/A		

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## VDOT Suffolk District Traffic Signals Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Railroad Crossing Traffic Signal Preemption (TSP)	Signal preemption granted to trains at railroad crossings (red signal given to traffic).	Operational on-going deployment	- Traffic signal preemption equipment	On-going deployment		<p>A train switch operates signal preemption at railroad crossings.</p> <p>All new signals within MUTCD specs for railroad preemption are equipped.</p> <p>Working to retrofit remaining signals that warrant railroad preemption.</p>
Fire Station Traffic Signal Preemption (TSP)	Signal preemption granted to fire vehicles at fire stations (red signal given to traffic).	Operational	- Traffic signal preemption equipment -push button activation	Operational		<p>Signal preemption at fire stations is push button controlled from the fire station.</p> <p>Where warranted, traffic signal preemption has been installed.</p>
Traffic Signal Upgrade and Expansion	Upgrade existing signals and expand the number of signals.	Under development	- Traffic signal hardware/software	Continuous	\$350,000	<p>An estimated per year cost.</p> <p>Actual costs per year may be more or less depending on the needs.</p> <p>Traffic signal controller equipment and software upgraded continually.</p>
Emergency Vehicle Traffic Signal Preemption (TSP)	Signal preemption granted to emergency vehicles at intersections.	Under development	- Traffic signal preemption equipment - Optical equipment	Continuous	\$7,000 per intersection	<p>All new and rebuilt signals are being equipped in the counties which we have an agreement.</p> <p>Retrofit of existing signals ongoing.</p>
*Traffic signal upgrade project	Traffic detection equipment evaluation.	Under development	- Loop detector	June-03		<p>Testing a detector loop amplifier that may be able to provide accurate counts regardless of the placement and length of the loop (stop bar loops).</p> <p>Currently, one intersection is equipped with these amplifiers and is undergoing testing.</p>

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

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Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Hampton ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
*Hampton Citywide Traffic Signal System	Centralized traffic signal control, traffic signal preemption/priority, arterial surveillance, and communications.	Under development	- Central office with workstation and monitors - over 63 miles of fiber optic cable - 109 system detector stations - 28 permanent count stations - traffic signal preemption/priority equipment at 100 intersections - 6 CCTV cameras	Estimated completion late Spring-04	\$7.2 million (VDOT, Hampton, CMAQ, Urban Funds)	Provide fiber optic links between NEMA traffic signal controllers throughout the city.  A central computer system will also be installed along with system detectors and video feeds.  Will use Opticom for traffic signal preemption/priority.
Mercury Boulevard CCTV Cameras	Arterial surveillance.	Under development	- 7 CCTV cameras	Estimated completion late Spring-04	\$215,000 for camera installation (VDOT, Hampton, CMAQ)	Provide CCTV cameras on Mercury Blvd. between the WCL and Fox Hill Road.
*City TMS / VDOT Smart Traffic Center Connection	Communications.	Under development	- Fiber optic cable - communications equipment	Estimated completion late Spring-04	\$500,000 (VDOT, Hampton, CMAQ)	Provide fiber optic link between the City TMS and the VDOT Smart Traffic Center.
Mercury Boulevard Signal Coordination	Inter-jurisdictional traffic signal coordination.	Under development	- Traffic signal hardware /software - timing plans - communications	Estimated completion late Spring-04	\$165,000 total (CMAQ)  \$40,000 for Hampton  \$125,000 for Newport News	Provide traffic signal coordination on Mercury Blvd. (US Route 258) between the James River Bridge and I-64. Joint project with Newport News.
Video Detection at Intersections	Traffic detection.	Under development	- Video detection cameras	On-going		These video cameras are used for detection only with no images being brought back to the City STC.
Convention Center ITS/Operational Enhancement	Traffic management, event management.	Under development	- 3 CMS for City - 2 CCTV for City	Estimated completion 2004	Part of a larger urban construction project	VDOT / City project.
Cameras along evacuation routes	Traffic monitoring, traffic management, emergency and incident management.	Potential	- CCTV	Application for funding pending	TBD	Application pending for CMAQ funding to deploy cameras along evacuation routes.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Hampton ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
ITS Asset Management Systems	Asset management.	Operational	- Built by City using COTS GIS tools-work order and inventory control system	Completed	\$48,000	In-house, City-developed, system.
School zone flashers	Traffic management.	Operational	- Linked to intersection and time of day based	Operational		
CAD/STC Interface with Hampton Police	Traffic management, incident and emergency management.	Potential	- Integration software	TBD	TBD	This would be a potential future project that would seek to enable the City to see what was being entered into CADS.  The intention would be a cost-effective interface for only sharing the traffic related concerns and incidents.
Arterial Flood Sensors	Detect and manage flooding on streets.	Potential	- Flood sensors	TBD	TBD	

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Newport News ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Portable CMS	Traffic information dissemination.	Operational	- Portable CMS	Completed	\$32,000 per CMS	
ITS Portable CMS	Traffic information dissemination.	Under development	- ITS portable CMS for City-wide use	June-06 - June-07	\$346,000	
Traffic Signal Preemption	Preemption granted to emergency vehicles at traffic signals.	Operational at 57 intersections	- Traffic signal preemption equipment	To be completed October-04	\$600,000	System uses Opticom.
*Newport News City Hall / VDOT TMS Communications Connection	Communications.	Planned	- 500 yards of fiber optic cable - communications equipment	2004 - 2007	\$140,000 (CMAQ)	Provide fiber optic link between Newport News City Hall and the VDOT Smart Traffic Center. The project is to coincide with VDOT's Phase 2 TMS project.  Designed FY2003 with construction in FY2004; request approved for diversion of \$70,000 from prior approved funds for operations connection to cover shortfall.
*Newport News TOC / VDOT TMS Communications Connection	Communications.	Under development	- 0.5 miles of fiber optic cable - communications equipment	2004 - 2007	\$440,000 (CMAQ)	Provide fiber optic link between the Newport News Traffic Operations Center (TOC) and the VDOT Smart Traffic Center.  The project is to coincide with VDOT's Phase 3 TMS project.  Existing project requires additional funding to provide a communications link from the TOC to the VDOT fiber backbone on I-64.  2004-2005/Planned/deferred pending trunk line construction along I-64 mainline (which was delayed for 2 years).

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Newport News ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
*Signal System Upgrade	Centralized traffic signal control (includes signal timing plans and a traffic responsive feature).	Planned	- Traffic signal hardware /software - timing plans - communications	Beginning in FY2004	\$9,500,000 (CMAQ)	Traffic signal system upgrades for 225 to 250 intersections.  The project includes the development of an ITS comprehensive plan, engineering study, and feasibility study which would begin in FY2004.
US Route 17 Traffic Signal System Upgrade and Timing	Traffic signal system upgrade, inter-jurisdictional traffic signal coordination.	Under development	- Traffic signal hardware /software - timing plans - communications	Construction to start FY2004	\$600,840 total (CMAQ) -- \$85,000 for Newport News \$515,840 for York County	Joint project with York County and VDOT.  Three of the 19 signals planned for the upgrade are in Newport News.  Under design by VDOT District Traffic Engineering 2003. FY04 construction planned.
Mercury Boulevard Signal Coordination	Inter-jurisdictional traffic signal coordination.	Under development	- Traffic signal hardware /software - timing plans - communications	2003	\$165,000 total (CMAQ) -- \$125,000 for Newport News \$40,000 for Hampton	Provide traffic signal coordination on Mercury Blvd. (US Route 258) between the James River Bridge and I-64.  Joint project with Hampton.  Coordinate Route 258 with Route 143 as a "grid" traffic control network for route diversion management and to reduce congestion.  Implementation deferred to 2003 pending City of Hampton compatibility decision on equipment selection.
Signal System Retiming Phases VI - XI	Arterial traffic control.	Planned	- Signal retiming software	July-07 through June-09	\$400,000 (CMAQ)	Continuation of the existing retiming program that retimes each traffic signal in the city on a three-year cycle.
Oyster Point Sub Area CCTV and Static Signs	Traffic monitoring, incident management.	Planned	- CCTV cameras at I-64 off-ramp locations from three interstate interchanges and two major intersections in City	June-07 to June-09	\$550,000	

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

**City of Newport News ITS Projects  
Projects Inventory**

**Hampton Roads ITS**

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Variable Speed Limit Signs	Traffic control.	Potential	- Variable speed limit signs	TBD	TBD	
Red Light Running Cameras	Traffic control /surveillance.	Potential	- Red light cameras	TBD	TBD	

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

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Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Norfolk ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
*Advanced Traffic Management System (ATMS)	Centralized traffic signal control, arterial surveillance, incident detection, traffic information dissemination, communications backbone.	Operational (220 of 278 total signals online. Planning and expansion continues.)	- Control center with workstations and monitors - 200 traffic signals with loop detectors (280 total planned) - 3 CCTV cameras operational, 5 under development (40 total planned) - 2 CMS signs (20 total planned) - 30 surface miles of fiber optic cable equaling 90 miles total	Operational	\$8,500,000 (CMAQ)	Five CCTV cameras are currently being installed on Military Highway.
Traffic Signal Preemption	Preemption granted to emergency vehicles at traffic signals.	Operational at 43 intersections	- Traffic signal preemption equipment	On-going Standard requirement for all new traffic signal installations.	\$7,000 per intersection	Uses Opticom
*Norfolk ATMS / VDOT TMS Communications Connection	Communications.	Operational	- Fiber optic cable - communications equipment - fiber optic data/video transfer equipment - video control software	Completed	\$370,000 (CMAQ)	Provide fiber optic link between the Norfolk Smart Traffic Center and the VDOT Smart Traffic Center.  Video has been operational since Fall 2002.  Data was interrupted in December 2002 and online again in May 2003.
Communication and Coordination with Norfolk and Norfolk Police	Traffic management, incident management.	Under development	- Communication links	2003		The City of Norfolk is engaged in communication with the Naval Base in order to mitigate the impacts of base operations on the City.
Parking Lot/Garage Kiosks	Interactive traveler information.	Planned	- kiosks - video detection equipment - variable message signs - traffic signal hardware/software - surveillance cameras	TBD	\$35,000 per kiosk	A conceptual plan has been developed for the deployment of interactive kiosks at Norfolk parking lots and garages (concept initiated by the parking department).

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Virginia Beach ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Traffic Signal Preemption	Preemption granted to emergency vehicles at traffic signals.	Operational	- Traffic signal preemption equipment	N/A	\$60,000	Retrofitted six intersections; uses Opticom See Project 1.3 for other pre-emption activities.
Portable CMS	Traffic information dissemination.	Operational	- 10 portable CMS with plans to order 3 more	N/A	\$396,000	Cellular controlled
CCTV	Arterial traffic monitoring.	Operational	-CCTV cameras - computer hardware/software	N/A	\$300,000	CCTV cameras are located on Atlantic and Pacific.
*City/State Fiber Optic Connection	Communications-Traffic Monitoring.	Under Development	- Fiber optic cable - communications equipment	N/A	\$125,000	Provides fiber optic link to the VDOT Smart Traffic Center and all Virginia Beach Police Precincts.
ITS Master Plan	Planning study.	Completed	N/A	Completed February 2002	\$300,000	Lays out a series of improvement projects to help implement the functions the Steering Committee determined most important to the City. The projects are grouped into five categories. Cost was for the study (CMAQ).
*Project 1.0 Detailed Design and Implementation Support for City-wide Traffic Signal System Improvements	Detailed engineering work and preparation of the plans and specifications for traffic signal system improvements.	Under development	N/A	Design to begin in Fall 2003 Phase 1 construction to begin 9/04	\$560,000	Estimated cost over the five phases of the project.
*Project 1.1 New Reliable and Efficient Traffic Signal Control System with Advanced Features	Traffic management.	Under development	- Central hardware and software - 330 signal controllers and cabinets - railroad pre-emption at 24 locations	Phase 1 to begin 09/04	\$3,792,800	Estimated cost over the five phases of the project.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test  
Under Development: projects that are procured (under contract) or being installed/constructed  
Operational: projects that have passed final inspection and are functioning  
N/A: not applicable

## City of Virginia Beach ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
*Project 1.2 Replacement of Loop Detectors with Above Ground Detectors	Traffic monitoring, traffic management.	Under development	- 2 RTMS overhead detectors fro 165 intersections - 4 Solo Video detectors at each of 90 intersections - Autoscope video detection at 21 intersections	Phase 1 to begin 09/04	\$3,481,500	Estimated cost over the five phases of the project.
Project 1.3 Preemption for Selected Emergency Vehicles	Preemption granted to emergency vehicles at traffic signals.	Under development	- Pre-emption equipment for 330 intersections- pre-emption enabling transmitters for 10 vehicles (to be procured by emergency service agencies)- en-route pre-emption equipment for 13 routes	Phase 1 to begin 09/04	\$1,233,100	Estimated cost over the five phases of the project. Cost for vehicle transmitters not included.
Project 1.4 Install Traffic Jam Cams	Traffic management and traffic monitoring.	Under development	- 60 locations for PTZ cameras	Phase 1 to begin 09/04	\$990,000	Estimated cost over the five phases of the project.
Project 1.5 Integrate School Crossing Flashers into New Signal System	Traffic management.	Under development	- 35 locations where school flashers will be integrated	Phase 1 to begin 09/04	\$187,000	Estimated cost over the five phases of the project.
*Project 1.6 Expand TOC at Landstown	Traffic management.	Under development	- Enhance the computer equipment space - large screen display with space for adjacent monitors - operating consoles - adjacent conference room	Phase 1 to begin 09/04	\$1,000,000	Estimated cost over the five phases of the project.
Project 2.0 Detailed Design and Implementation Support	Detailed engineering work and preparation of the plans and specifications for the Group 2 projects reference in the Master Plan.	Under development	N/A	Phase 1 to begin 09/04	\$148,500	Estimated cost over the five phases of the project.
Project 2.1 Install Flood Monitoring and Warning Sign System	Roadway condition monitoring, traveler information.	Under development	- High water detectors at 34 locations - 2 active warning signs at the 34 detector locations	Phase 1 to begin 09/04	\$1,122,000	Estimated cost over the five phases of the project.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Virginia Beach ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Project 2.2 Install Icy Bridge/Road Monitoring System	Bridge condition monitoring, traveler information.	Under development	- Utilize RWIS and communications equipment to determine roadway segment condition with regard to freezing conditions. - 10 locations to be outfitted with "Icy Bridge and Road Monitoring Systems"	Phase 1 to begin 09/04	\$82,500	Estimated cost over the five phases of the project.
Project 2.3 Support E911 Through the Installation of Oversize Street Signs and Milepost Markers	Incident and emergency management.	Under development	- 2 signs at each of 50 cross streets on 10 routes	Phase 1 to begin 09/04	\$330,000	Estimated cost over the five phases of the project.
Project 3.0 Detailed Design and Implementation Support	Detailed engineering work and preparation of the plans and specifications for the Group 3 projects reference in the Master Plan.	Under development	N/A	Phase 1 to begin 09/04	\$137,500	Estimated cost over the five phases of the project.
Project 3.1 Expand Highway Advisory Radio (HAR) System for Tourist and Traffic Information	Traveler information, traffic management, incident and emergency management.	Under development	- 3 HAR transmitters - 10 HAR alert signs	Phase 1 to begin 09/04	\$550,000	Estimated cost over the five phases of the project.
Project 3.2 Install Permanent CMS at Selected Locations	Traveler information, traffic management, incident and emergency management.	Under development	- 6 locations for CMS (including sign, pole, and foundation)	Phase 1 to begin 09/04	\$660,000	Estimated cost over the five phases of the project.
Project 3.3 Install Small Detour Route Signs at I-264 Interchanges and on Parallel Arterials	Traveler information, traffic management, incident and emergency management.	Under development	- Install signs at 30 locations	Phase 1 to begin 09/04	\$165,000	Estimated cost over the five phases of the project.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Virginia Beach ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Project 3.4 Share Data and Video with VDOT and Neighboring Cities	Communications.	Under development	<ul style="list-style-type: none"> <li>- Establish communications link with VDOT STC, which will enable an eventual communications link with other regional transportation centers.</li> <li>- Establish communications link to the City of Norfolk.</li> <li>- Establish communications link to City of Chesapeake.</li> </ul>	Phase 1 to begin 09/04	\$55,000	<p>Estimated cost for VAB DPW for labor and equipment over the five phases of the project. However, project costs are envisioned to be shared amongst linking agencies.</p> <ul style="list-style-type: none"> <li>- VDOT will construct a communications hub building at First Colonial Road, which could be used as the interface point between the two systems.</li> <li>- VAB cable plant extends to Norfolk city line and the 150 twisted pair cable that runs along Virginia Beach Boulevard is well situated to serve as the link to Norfolk.</li> <li>- Chesapeake link would facilitate coordination of signals on nearby routes.</li> </ul>
Project 3.5 Export Video and Congestion Status Map to Local TV Stations and Regional Transportation Web Pages	Traveler information, traffic management, incident and emergency management.	Under development	<ul style="list-style-type: none"> <li>- Video sharing equipment and labor to implement</li> </ul>	Phase 1 to begin 09/04	\$55,000	Estimated cost over the five phases of the project.
Project 3.6 Install Parking Information System	Parking management.	Under development	<ul style="list-style-type: none"> <li>- 10 smaller CMS as part of a sign system to direct drivers to City-owned parking facilities near the beach.</li> </ul>	Phase 1 to begin 09/04		Estimated cost over the five phases of the project.
Project 3.7 Link School Bus Automatic Vehicle Location (AVL) System to City Web Site and/or Cable TV Channel	Traveler information and safety.	Under development	<ul style="list-style-type: none"> <li>- Software development and implementation</li> </ul>	Phase 1 to begin 09/04	\$110,000	This is the estimated cost for the DPWs role and use of a larger City-wide AVL initiative as called out in the Master Plan as Project 4.2. The lead City agency for the larger City-wide AVL software project is the Department of Emergency Communications with each agency responsible for the purchase and implementation of its own AVL equipment.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

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Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Virginia Beach ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Project 4.0 Detailed Design and Implementation Support	Detailed Information Technology (IT) work required for the implementation of the projects in Group 4.	Under development	TBD	Phase 1 to begin 09/04	TBD	The co-lead organizations for this project will be the DPW and Virginia Beach's IT Department (ComIT)
Project 4.1 Place Traffic Data and Video of Selected Intersections on City WAN and LAN	Traveler information, traffic management, incident and emergency management.	Under development	- Enabling technology, including software and video encoders	Phase 1 to begin 09/04	\$44,000	Estimated cost over the five phases of the project.
Project 4.2 City-Wide AVL System to Monitor Locations of School Buses, Public Works Department Vehicles, Police Cars, Fire Department Apparatus and Other Mobile City Assets	Emergency and incident management, asset management, traffic management, work zone management.	Under development	- Central software for City-wide AVL	Phase 1 to begin 09/04	TBD	The Citywide procurement should minimize the cost of the AVL equipment installed on individual vehicles. The central AVL and CAD software will be the same for all City agencies and initially will only be purchased by the DEC. Other City agencies will pay for workstations and any modifications to the basic software.
Project 5.1 Conduct Needs and Feasibility Study for Reversible Lanes	Travel demand management.	Under development	N/A	Phase 1 to begin 09/04	\$55,000	Estimated consultant fees for the specific project.
Detection Demonstration Project and Traffic Signal Upgrade	Arterial surveillance, adaptive signal control.	Research	- Video detection equipment- audio detection equipment- traffic signal hardware/software	June 2000	\$600,000 (two \$300,000 CMAQ grants)	Video detection and audio detection are being tested in a demonstration project to support future signal operational improvements. Virginia Beach would like to move to a traffic adaptive system when it has reliable detection in place. Radar was previously tested and rejected because it was not reliable.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Chesapeake ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Autoscope Video Detection	Arterial surveillance, adaptive signal control.	Operational; additional deployments are planned	- Video detection equipment	On-going	\$155,000 total	Autoscope detection is installed at the intersection of Dominion and Great Bridge and is planned along SR 168 and Portsmouth Blvd. Chesapeake is interested in the capabilities Autoscope provides such as counting and surveillance.  Microwave and radar were also investigated, but Autoscope is preferred.
*Citywide Fiber Optic Cable / Communications Ring	Communications.	Under development (presently, under construction as part of Phase 2)	- Fiber optic cable - communications equipment - CCTV cameras - ATMS central software	Phase 1 to be complete in 2003  Phase 2 on-time to be completed in 2004	\$4,000,000 total for Phase 1 and 2 (CMAQ)	Interconnect all traffic signals, CMS signs, and video monitoring sites.
*Traffic Signal Controller Upgrade	Traffic signal system upgrade.	Under development (presently, under construction as part of Phase 2)	- TS-2 controllers	Phase 1 to be complete in 2003  Phase 2 on-time to be completed in 2004	\$4,000,000 total for Phase 1 and 2 (CMAQ)	Chesapeake is in the process of replacing all of its TS-1 controllers with TS-2 controllers. As of October 1999, the city had approximately 45 TS-2 controllers and 80 TS-1 controllers.
*VDOT STC Interconnect (share data and video with VDOT and other jurisdictions)	Communications.	Under development	- Establish communications link with VDOT STC, which will enable an eventual communications link with other regional transportation centers.	To be completed with Phase 2 in 2004		
ITS Master Plan	Planning study.	Completed	N/A	Completed	\$70,798	The planning study examined the replacement of Chesapeake's central control software, controllers, and communications and detection needs and possible solutions.
Traffic Signal Interconnect	Inter-jurisdictional traffic signal coordination.	Under development	- Traffic signal hardware /software - communications	TBD	TBD	Interconnect project with Virginia Beach to coordinate traffic signals on Kemptsville Rd. and the Volvo-Lynnhaven Pkwy.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

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Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Chesapeake ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Traffic Signal Preemption	Preemption granted to emergency vehicles at traffic signals.	Under development	- Traffic signal preemption equipment	Due to be bid Summer 2003 begin deployment in September-03	\$15,000 to date	Opticom was tested at three locations. Chesapeake also tested Sonex preemption with little success. Opticom/Tomar will be the system to be utilized.
VDOT Smart Tag Electronic Toll Collection System	Toll collection.	Operational	- Toll tags for vehicles - toll tag readers	Completed May-01		The 16-mile Chesapeake Expressway (Route 168) links I-64 to North Carolina's Outer Banks.  Compatible with VDOT toll systems.
Automated Red-Light Running Enforcement	Traffic management.	Potential	- Video detection equipment - red-light running systems	TBD	TBD	Automated red-light-running is under preliminary consideration.  If the project was to move forward City police would take the lead.
Traffic Signal Coordination	Inter-jurisdictional traffic signal coordination.	Potential	- Traffic signal hardware /software - communications	TBD	TBD	Chesapeake would like to coordinate traffic signals with Suffolk.
Arterial Flood Sensors and Signs	Detect and manage flooding on streets, post road closures.	Potential	- Flood sensors - dynamic signage	Phase 2	TBD	Detect the depth of floodwaters in streets and automatically post a road-closed sign.
Arterial CMS	Traffic information dissemination.	Potential	- Arterial CMS	Phase 2	TBD	Deployment of CMS signs on arterials throughout the city.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

123

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Portsmouth ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Portsmouth Citywide Computerized Traffic Signalization Project, Phase 1	Centralized traffic signal control.	Operational	- Computerized traffic signal system at 25 intersections - radio frequency communications	Completed	\$3,600,000 million total for Phases 1 & 2 (CMAQ)	System uses radio frequency communications between the central computer and signal controllers.
*Portsmouth Citywide Computerized Traffic Signalization Project, Phase 2	Centralized traffic signal control, arterial surveillance, and communications.	Planned (RFP issued in November 1999)	- Computerized traffic signal system at an additional 18 intersections - radio frequency communications	Year 2000	\$3,600,000 for Phases 1 & 2 (CMAQ)	
Portsmouth Citywide Computerized Traffic Signalization Project, Phase 3	Centralized traffic signal control, arterial surveillance, and communications.	Potential	- Computerized traffic signal system at remaining signalized intersections - radio frequency communications	Future projects available, however funding source has not been identified.	\$2,000,000	No money has been allocated yet for Phase 3.
Portable CMS	Traffic management, traveler information dissemination.	Planned	- Portable CMS	Estimated 2006 - 2007	\$364,000 (CMAQ)	
Signal System Upgrades as part of VDOT Construction Project	Traffic control.	Under development	- Signal system equipment	On-going		As VDOT projects come on-line urban planning dollars are used to implement ITS and signal enhancements in conjunction with larger construction projects.
School Zone Flashers	Traffic management.	Operational	- Tied to central software - flashing signs in school zones	Operational		
Portsmouth TOC / VDOT TMS Communications Connection	Communications.	Planned	- Communications equipment	TBD	TBD	Portsmouth has the resources to connect with VDOT, currently determining internal tasks and timeframe for connection.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

124

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Suffolk ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Washington Street Corridor Signal Rebuild/Coordination	Traffic signal system upgrade / coordination.	Operational	- Multisonic 828 controllers - on-street arterial master (OSAM) with closed loop communications	N/A	\$135,000 (CMAQ)	Eight existing intersections and 1 new location were rebuilt and incorporated into a closed loop system.
Main Street & Constance Road Intersection Rebuild	Traffic signal system upgrade.	Operational	- Multisonic 828 controller	N/A	\$644,000 (CMAQ)	Included geometric improvements. Intersection will be linked to closed loop system in the future.
North Main Street Signal Coordination Project	Traffic signal system upgrade / coordination.	Operational	- Multisonic 828 controllers - on-street arterial master (OSAM) with closed loop communications	N/A	\$458,000 (CMAQ)	Rebuilt signals at 6 intersections on Main St. and linked to form closed loop system.
Downtown Signal Coordination	Traffic signal system upgrade / coordination.	Operational	- Multisonic 828 controllers - on-street arterial master (OSAM) with closed loop communications	RFP to be released in November 1999; construction to begin in February 2000; complete in June 2000	\$145,000 (CMAQ)	Rebuilt signals at 5 intersections in downtown Suffolk and link to form closed loop system.
Engineering Retiming Project	Signal timing, re-evaluation of the traffic signal system projects, system inventory examination.	Planned	- Timing plans - inventory - evaluation	RFP has been completed	\$150,000	Will retime the entire traffic signal system.
*Signal Control Outside of Suffolk	Traffic signal system upgrade / coordination.	Planned	- Multisonic 828 controllers - on-street arterial master (OSAM) with closed loop communications	2003 - 2005	\$754,000	Will incorporate some of VDOT's traffic signals into Suffolk's closed loop system. Consists of 6 projects.
Emergency Vehicle Traffic Signal Preemption	Preemption granted to emergency vehicles at traffic signals.	Planned	-Traffic signal preemption equipment	Beginning in 2001	\$250,000	Currently discussing plans with the fire department.  Plan to use Opticom.  Capability is built into traffic controllers, but need to deploy/integrate the system.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

125

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## City of Suffolk ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
ITS Asset Management System	Asset management.	Planned	- Software	2004/2005 begin to use		
Portable CMS	Traffic information dissemination	Planned	2-3 Portable Variable Message Signs (CMS)	TBD	\$80,000	Cellular controlled
Citywide Fiber Optic Cable	Communications	Potential	- Fiber optic cable - Communications equipment - CCTV cameras - ATMS central software	TBD	TBD	Interconnect all traffic signals, CMS signs and CCTV sites
Arterial Flood Sensors and Signs	Detect and manage flooding	Potential	- Flood sensors - Dynamic signals	TBD	TBD	Detect flood waters and automatically post road closure
Traffic Signal Preemption	Preemption granted to emergency vehicles and traffic signals	Under development	- Traffic signal preemption equipment	Phase I July 2005	\$250,000	Opticom selected isolated signals already incorporated
ITS Master Plan	Planning study	Potential	N/A	TBD	\$150,000	Planning study to examine existing equipment, software, and communications and recommend additions and integration

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## York County ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
US Route 17 Traffic Signal System Upgrade and Timing	Traffic signal system upgrade, inter-jurisdictional traffic signal coordination.	Under development (project began work in June-03)	- Traffic signal hardware /software - timing plans - communications	On-going	\$600,840 total (CMAQ) \$85,000 for Newport News \$515,840 for York County	Joint project with Newport News and VDOT. Sixteen of the 19 signals planned for the upgrade are in York County. Currently working with Newport News to coordinate timings.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

127

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Hampton Roads Transit ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Transit Information Enterprise System (TIES)	Combines operation and customer service benefits of ITS with the business and financial management capabilities of Enterprise Resource Planning (ERP) in an integrated data-sharing environment.	Under development	- Custom integration software that "ties" many of the HRT most important software tools together	On-going		TIES is a cooperative venture between HRT staff and departments, including: IT, O&M, Marketing and Customer Service, Planning and Scheduling, Financial Services, Procurement, Human Resources, Risk Management, Payroll, grants management, and Projects Management
Advanced Fixed-Route Scheduling and Operator Dispatch System (New Project)	Transit vehicle management.	Operational	- Hardware and software - master GIS program will reside in this software system - important precursor to trip planning and many CAD/AVL functions	Completion date October-03	\$1,600,000 million for hardware, software and training	Phase 1 of the project (e.g. scheduling functions) is in production use.  Phases 2 and 3 (operator dispatch and ridership functions) are due to be complete by October 2003.
Automatic Vehicle Location (AVL)	Surveillance / transit operations -- provides real-time location of transit vehicles.	Under development	- Differential GPS-based on-board AVL equipment - emergency silent alarm / digital camera alert system - next stop announcements and head signs - dispatch workstation - wireless communications	Final specifications for new radio and CAD/AVL system due to be complete by October 2003. Procurement November 2003 - March 2004; Implementation 2004- 2005.	\$1,600,000 - \$18,000,000 million for radio system, CAD/AVL hardware/software and training.	Pilot CAD/AVL system using GPRS technology is being implemented for Trolley vehicles on Oceanfront Atlantic Ave.  route in progress. This system is due to "go live" July 1, 2003.  Larger radio-based CAD/AVL system is in final design phase.
Automatic Passenger Counters (APC)	Surveillance / transit operations -- collects passenger boarding and alighting automatically.	Under development	- APC units			Will be installed on 15% of fleet in conjunction with system-wide CAD/AVL implementation

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Hampton Roads Transit ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
TRAFFIX	Provide commuters transit information and instant matches for ridesharing.	Operational	- Computer hardware - computer software/database	N/A	\$600,000 for implementation (STP)  \$1,100,000 million annual budget for program	
Trip Itinerary Planning with GIS	Traveler information -- provides personalized transit trip itineraries using GIS.	Planned	- GIS software/database- itinerary planning software- computer hardware	2006	\$300,000	A customer will be able to obtain a trip itinerary via the Internet or a call center agent. The GIS database program has been consolidated and upgraded as part of the fixed-route scheduling system. Interactive, web-based trip planning software implementation to occur around 2006.
Bus Monitoring Camcorders	Surveillance -- transit vehicle safety and security.	Planned	- Video cameras - VCR	2008	\$41,400 (federal, state, and local funding)	Currently in procurement for installation of 4 cameras per bus on an additional 250 buses between 2003 and 2008.
Information Kiosks	R&D project using kiosks to access TRAFFIX information.	Under development	- Interactive kiosks	TBD	\$100,000	Currently in planning phase, limited implementation to occur after CAD/AVL implementation.
Smart Cards	Electronic fare payment.	Planned	- Smart cards / magnetic stripe cards - card reader / fare box - ticket vending machines	Unknown		Electronic fare boxes are part of the CAD/AVL projects above.
Traffic Signal Priority (TSP)	Transit operations -- provides priority to buses at traffic signals.		- TSP vehicle equipment	TBD		Operational for one traffic signal at Wards Corner in Norfolk.  Additional TSP would occur after CAD/AVL implementation.  CAD/AVL system design accommodates use of TSP systems.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Hampton Roads Transit ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Incidence Response System	Transit vehicle security, customer safety and security.	Operation on-going	- On vehicle equipment	2004 and ongoing		Allows entry onto buses within 60 seconds without the need for drivers to open the doors. Also provides for external real-time monitoring of that is going on inside the bus.  All new buses currently on order and in the future are being equipped with special counter-terrorism equipment.
HRT connection to VDOT STC for video and data exchange	Transit management, transit vehicle routing, customer safety and security.	Research	- Communication equipment - software and hardware	TBD		Data from HRT to VDOT STC could include incident Data, transit routing / scheduling diversions, real-time vehicle location, indications of traffic flowData from VDOT STC to HRT could include incident Data, road/tunnel/bridge closure information, traffic flow Data, route diversion Data
Virginia Beach Trolley Headway System	Transit vehicle fleet management.	Operational	- GPS and AVL equipment on buses - cellular modems - general packet radio service (GPRS)	Completed for Virginia Beach considered for other applications	\$473,510 (CMAQ)	

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

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Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Chesapeake Bay Bridge Tunnel District ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Emergency Call Box System	Incident detection (typically vehicle break-downs) via call box telephones along the roadside.	Operational	- Roadside call box equipment - telephone system	N/A	\$100,000	Call boxes are located at 0.5 mile intervals along the Chesapeake Bay Bridge-Tunnel.
Road Weather Information System	Monitors weather conditions on or near the roadway.	Operational	- Wind gauges - roadway temperature sensors	N/A	\$2,000	Wind gauges are located at the southern and middle sections of the facility. Temperature sensors are located on the roadway.
Electronic Toll Collection	Collect tolls electronically.	Potential	- Vehicle transponder (tag) - roadside reader unit - video enforcement system (VES) - computer hardware/software	On-going study	TBD	Will be revisited at a later time to determine the implementation potential and projected costs.  Commuter Toll Impact Study completed in 2001
Dedicated # XX Cellular Call-in Program	Incident detection via motorist cellular call-ins.	Potential	- Dispatch workstation - static signage	TBD	TBD	Will be revisited at a later time to determine the implementation potential and projected costs.
CMS system	Traffic information dissemination.	Operational	- CMS signs - computer hardware/software	Completed	TBD	
Portable CMS	Traffic information dissemination.	Operational	- Portable CMS	Completed		

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Williamsburg Area Transport ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Incident Management Communications Network	Incident management.	Operational	- Computer hardware/software - communications	N/A	Unknown	The Emergency Services Division of James City County provides incident reports, via e-mail, to other James City County divisions, including James City County Transit.
Automatic Vehicle Location (AVL)	Surveillance / transit operations -- provides real-time location of transit vehicles.	Unknown (last updated 2000)	- On-board location equipment - dispatch workstation - wireless communications	TBD	\$90,000	Developing long-range public transit plans beginning in September 1999.  Recommendations are expected by March 2000.
Interactive Kiosks	Traveler information.	Unknown (last updated 2000)	- Interactive kiosks	TBD	\$50,000	Developing long-range public transit plans beginning in September 1999.  Recommendations are expected by March 2000.
Traffic Signal Priority (TSP)	Transit operations -- provides priority to buses at traffic signals.	Unknown (last updated 2000)	- TSP vehicle equipment	TBD	TBD	Developing long-range public transit plans beginning in September 1999.  Recommendations are expected by March 2000.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Virginia State Police ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
# 77 Cellular Call-in Program	Incident detection via motorist cellular call-ins.	Operational	- Telephone equipment	N/A	\$1,000	Currently, the Virginia State Police receives cellular 911 and # 77 calls and forwards the cellular 911 calls manually to the appropriate jurisdiction.  Starting January 1, 2000, incoming cellular 911 calls will be separated from # 77 calls and the 911 calls will be forwarded automatically to the appropriate jurisdiction.
Computer-aided Dispatch (CAD) System	Emergency Response -- assists the dispatcher in assigning calls to the appropriate trooper; creates records.	Operational	- Computer hardware/software	N/A	Unknown	
Mobile Computer Terminal	Portable in-vehicle computer with digital communications.	Under development	- Computer hardware/software - wireless communications	Currently being installed, project about 50% complete	\$10,000 per terminal (\$1,580,000 total for the Tidewater area)	The mobile computer terminal is a laptop computer located in the police vehicle with digital communications to the emergency management center. The system integrates with the CAD system. May include a GPS feature to locate vehicles in distress.
Radio System Upgrade	Communications upgrade.	Potential	- Voice/data radio equipment	Implementation would start in 2009 to 2011	TBD	The upgrade may be part of a statewide radio system serving several Virginia state agencies.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Virginia Port Authority ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Traveler Information Systems	Traffic information dissemination.	Potential	- CMS signs - HAR	TBD	TBD	The Virginia Port Authority (VPA) is interested in having traffic information provided to CVO operators. It is also interested in having train schedule information provided to drivers at crossings near its facility. The VPA would like transportation agencies to collect and disseminate this information, and would like to study the concept further.
Norfolk International Terminal (NIT) Command and Control Center	Replaces VSP headquarters in warehouse 4 that is scheduled for demolition, provides state of the art facility for security.	Under development	- Central control hardware and software - facility	Completed by July 2004	\$5,543,400	VPA has a dedicated VSP unit that will man the operations center.
Portsmouth Marine Terminal (PMT) ID and Security Building	Provides ID issuing facility, PMT police building.	Under development	- Security software and hardware - field devices for detection and monitoring	Completed by summer 2004	\$1,268,200	
Credentialing System and Smart Card	Security and credentialing.	Under development	- Security software - smart cards and accompanying equipment and technologies	On-going development		The VPA is in the process of developing a credentialing system / card for customers. The cards will include pictures, smart card characteristics, and biometric information.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

Planned: projects that are officially planned or programmed

Research: an analysis, study, or operational test

Under Development: projects that are procured (under contract) or being installed/constructed

Operational: projects that have passed final inspection and are functioning

N/A: not applicable

## Norfolk Naval Station ITS Projects Projects Inventory

## Hampton Roads ITS

Project/System Name	Function/Description	Status	Component/Equipment Types	Implementation Time Period	Estimated Cost (\$)	Comments
Actuated Traffic Signal System	Actuated traffic signal control, arterial surveillance.	Operational	- Traffic signal hardware /software (including detectors) - timing plans - communications	N/A	Unknown	The traffic signals on the base are fully actuated operating on a fixed time schedule.
VDOT and City of Norfolk Arterial CMS	Traffic information dissemination.	Operational	- Arterial CMS	VDOT: late fall 2000; Norfolk: operational in February 2000	\$100,000 per CMS	VDOT is planning to deploy CMS signs at naval station gates 1, 3, and 3A. Norfolk has installed two CMS signs (not yet operational) in the vicinity of the naval station.
Hampton Blvd. and City of Norfolk Coordination	Traffic Management.	Under development	- Coordination is on-going to help manage impacts of increased security at gates	On-going planning		
CCTV Study	Arterial surveillance.	Research (completed)	- CCTV cameras	Study was conducted in 1995	\$35,000 per intersection for CCTV deployment	The study recommended installing CCTV cameras at the intersections of Hampton & Taussig, Taussig & Gate 5, and some intersections along Terminal Blvd. The cameras would be used to monitor traffic levels at those intersections and would provide of means of determining whether to change the signal timing at the intersections. Implementation and operation would be conducted by the City of Norfolk.
Communication and Coordination with Norfolk and Norfolk Police	Traffic management, incident management.	Under development	- Communication links	2003		The City of Norfolk is engaged in communication with the Naval Base in order to mitigate the impacts of base operations on the City.

\*This project is also identified on the 2026 Strategic Milestones Project Matrix  
Potential: recommended or desired projects

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Research: an analysis, study, or operational test

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N/A: not applicable



## **APPENDIX C: Summary of Challenges Identified by Stakeholders**

### **Program Area:** ***Systems Integration***

#### **Planning and Implementing Regional Integration**

##### **Coordination:**

- The roles and responsibilities of systems/organizations have not been clearly defined for an integrated environment. (Who is responsible for what and when?)
- Technological challenges of integrating systems and achieving interoperability have not been fully addressed.
- Standards, protocols, and agreements supporting integration are not in place.

##### **Integration:**

- Organizations/systems are not currently integrated with 511, Regional ATIS, and Regional Transportation websites.
- System/organizations that need to be transferring data/information have not been identified. Some of the systems that need to be integrated include:
  - Virginia State Police (VSP) CAD and/or City Police CAD,
  - Hampton Roads Transit (HRT) systems, and
  - VDEM's Evacuation Traffic Information System (ETIS).

#### **Communications Infrastructure**

##### **Integration-Enabling Communications:**

- A communications backbone supporting the exchange of information between agencies does not currently exist. The backbone should enable ATIS data and video-sharing among agencies.
- Determine future communications requirements for linking the RMMS with other systems.
- The VDOT Smart Traffic Center (STC) is not integrated with local systems, which limits the flow of traffic information throughout the Region.

#### **Education**

##### **Leadership Training:**

- Several stakeholders in the Region lack a complete understanding of the utility of systems integration.

**Program Area: *Incident & Emergency Management***

<b>Coordination of Operations</b>
<b>Emergency Coordination:</b> <ul style="list-style-type: none"><li>▪ Real-time information is not currently disseminated effectively in the event of a Homeland Security threat.</li><li>▪ The Region is lacking a central, Region-wide authority and database to assist with coordinating transportation activities, evacuations, etc. during incidents and emergencies.</li><li>▪ The capability for Regional dissemination of incident information is not completely sufficient among transportation system stakeholders.</li><li>▪ There is a lack of rapid communication (conference call systems) during emergencies.</li><li>▪ “Mass-transit” stakeholders do not have a clear role during emergencies and evacuations.</li><li>▪ There is a lack of understanding and working knowledge among stakeholders regarding Regional diversion routes, including: cooperation, roles, resources, and purchasing needs.</li><li>▪ There is not an operational links between incident and emergency management.</li></ul>
<b>Resources and Tools:</b> <ul style="list-style-type: none"><li>▪ Formal institutional relationships are not in place among VDOT, VSP, VDEM, federal entities, military, and local jurisdictions.</li><li>▪ Connections and relationships between transportation stakeholders and Regional Ports/Security installations and operations have not been developed.</li><li>▪ Regional resources for incident/emergency management among military, city, and state are not fully utilized.</li><li>▪ An understanding of the operational impacts to the transportation system when military/security/port facilities react to the various national emergency status indicators does not exist.</li></ul>
<b>Transportation Information During Emergencies:</b> <ul style="list-style-type: none"><li>▪ There are not currently plans for disseminating transportation data during emergencies and power losses.</li></ul>

<b>Planning</b>
<b>Response Plans:</b> <ul style="list-style-type: none"><li>▪ In light of the Hurricane Isabel experience, local jurisdiction Incident Response Plans proved to be outdated and did not ensure consistency and compatibility with other</li></ul>

## Planning

- jurisdictional, regional, and statewide response plans.
- Regional evacuations will generate would likely exceed transportation system capacity, depending on time of decision and time needed to evacuate. There is limited planning to account for this.
  - Critical corridor and routes under different scenarios; include redundancies for inaccessible routes or damaged tunnels/bridges have not been completely defined.
  - Procedures have not been defined for monitoring and managing conditions (road, accessibility, weather, traffic, incidents) during incidents, emergencies, and evacuations.
  - The impact on the Region of a coastal North Carolina evacuation prior to, or concurrent with, a Hampton Roads evacuation has not been fully addressed.
  - The impact of concurrent military base evacuations has not been fully addressed.
  - Planning for evacuation of tourists has not been fully addressed.
  - Planning for evacuation of special needs citizens/facilities has not been fully addressed.
  - HRT/mass transit's role in evacuations is not clearly defined.
  - Detailed evacuation procedures do not currently exist (agency/staff responsibilities, reversible lane requirements, signal requirements, etc.)
  - Shelter demand for mass evacuation and how to get people the information they need as they approach the "shelter" areas needs to be further looked into.
  - There is limited planning for monitoring and surveillance during an evacuation – road/route usability conditions, traffic conditions, etc.
  - Distribution of current, reliable information to the general public is not always applicable during emergencies.

## Infrastructure Protection & Continuity of Operations

### Asset Management:

- Transportation assets are not completely protected from natural disaster and security threats.
- "Mission Critical" facilities need to be defined. Possible facilities may include:
  - Regional TOC's/STC's are "mission critical",
  - Truck weigh stations,
  - Field equipment,
- Electrical back-up plans have not been defined for "mission critical" facilities.

### Continuity:

- There is not a plan in the Region for back-up of electrical generation capabilities at key Regional operations centers and STC's.
- There are not back-up electrical generation capabilities at commercial vehicle weigh stations and hazardous materials check-points.
- Plans for intersection monitoring and management do not exist during power outages.

## System Monitoring and Performance

### Weather Information:

- Comprehensive, reliable Regional weather inputs are not available during natural disasters and emergencies.

### Route Monitoring During Diversions & Evacuations:

- Regional route diversion management for freeways and arterials is not sufficient.
- Traffic conditions and activities are not monitored during evacuations.

### **System Monitoring and Performance**

- In the recent execution of the Norfolk route diversion in response to the Mid-Town Tunnel closure, the volumes of traffic that the City expected would use the detoured route were not observed.

### **Incident Detection Requirements:**

- Regional incident detection/verification procedures are not sufficient.
- Traffic condition information is not always accurate, real-time, and dependable information.
- Automation for channeling E911 calls about traffic/transportation incidents does not exist in the Region.
- Dispatching schemes for responding to incidents just over jurisdiction boundaries are not in place. (Could city law enforcement work to secure scenes that are closer to location of given resources?)
- Dispatchers/responders are not furnished with traffic information that will enable them to identify optimal routing to incidents, given real-time conditions.
- Informational “snapshots” of incidents are not provided to dispatchers/first responders.
- MOU’s have not been developed for response so that parties closest to an incident can respond, regardless of jurisdictional boundaries.
- The Freeway Incident Response Team’s (FIRT) role when accidents are off freeways has not been clearly defined.

### **Data Retention:**

- The information that would be most valuable, as input into the Emergency Transportation Information System (ETIS) has not been defined.
- Methods for integrating Regional monitoring and detection systems into ETIS are not in place.

### **Management Tool:**

- The Region lacks a mobile incident command vehicle for the Region.

## **Education**

### **Public and Staff Training:**

- Regional transportation staff, FIRT staff, etc. are not completely educated on specific procedures, e.g., implementation of reversible lanes.
- The public is unaware of where to go to get information during disasters. They need to be better educated.
- The public is not always advised on use of detours/diversion routes.

### **Leadership Training:**

- Methods institutionalize strategies are not in place.
- Executives and champions are not always fully educated on the role of ITS in the Region.

**Program Area: *Transportation Management***

<b>Coordination of Operations</b>
<b>Signal Timing:</b> <ul style="list-style-type: none"><li>▪ Signal timing plans and coordination are often outdated.</li><li>▪ Signal timings are not adjusted based on real-time event data.</li><li>▪ There is limited coordination among organizations that deal with planning and traffic.</li></ul>
<b>Operational Standards:</b> <ul style="list-style-type: none"><li>▪ Coordination needs to be improved within and between agencies on the status of roads, bridges (e.g., raisings) and tunnels.</li><li>▪ There is not a common Regional practice for signal operations.<ul style="list-style-type: none"><li>○ The timing and operation of flashing warning lights at school speed zone signs is inconsistent across the Region.</li></ul></li></ul>
<b>Traffic Management During Special Events and Through Work Zones:</b> <ul style="list-style-type: none"><li>▪ Regional traffic management during special events needs to be improved.</li><li>▪ Major special events, e.g., the 2007 Jamestown celebration are not always planned for.</li><li>▪ The Region does not maintain and share a calendar of planned/special events.</li><li>▪ Bridge raisings are not always anticipated and coordinated during special events.</li><li>▪ The traffic management role of transit during special events does not always exist.</li><li>▪ For significant special events, coordination of operations across jurisdictional boundaries does not always take place.</li><li>▪ Congestion related to work zone areas is not always addressed. Work zones need to be better managed by utilizing “project-based” traffic management systems.</li><li>▪ Highway contractors do not always understand their responsibilities to maintain traffic through work zones.</li><li>▪ There is a lack of communications between contractors and surrounding jurisdictions – e.g., cities are often among the last to know about changes to traffic patterns and flows through work zones.</li></ul>
<b>Communications Infrastructure</b>
<b>Communications to Support Traffic Management:</b> <ul style="list-style-type: none"><li>▪ Communications, particularly aboveground hubs, need to be hardened.</li><li>▪ Innovative solutions for back-up to communications outages do not exist in the region.</li><li>▪ Harden communications to field devices; when communications are down, remote polling and monitoring of field equipment is not possible.</li></ul>
<b>Planning</b>
<b>Future Traffic Patterns:</b> <ul style="list-style-type: none"><li>▪ The future of traffic generators, vehicles, and Regional growth and demographic patterns is not fully understood.</li></ul>
<b>Monitoring and Performance</b>
<b>Regional Choke-Points:</b> <ul style="list-style-type: none"><li>▪ Chronic, recurring congestion at key facilities, e.g., the Hampton Roads Bridge-Tunnel have not been addressed.</li></ul>
<b>Signal System Status:</b>

### **Monitoring and Performance**

- Jurisdictional traffic signal projects are not complete and there is little planning for future system needs.
- Traffic signal systems are outdated and lack central control.

### **Signal Pre-Emption and Priority:**

- Emergency vehicles often get tied up at signalized intersections because they do not have the capability to pre-empt signals at key traffic signals.
- Transit vehicles often are tied up at traffic signals forcing them to get off schedule. Signal priority opportunities need to be studied.

### **Performance Measures:**

- Traffic volume data for monitoring traffic flow on freeways and arterials is not being collected.
- Corridor-based traffic data has not been developed. This may be in part because point-detection has limitations.
  - Potential AVL probe vehicle opportunities with HRT, FIRT, and City vehicles.
  - Potential use of toll-tag readers.
- Traffic data collected is not always archived.
- Information on traffic flows is inadequate due to less than full detection capabilities on major arterials.
- Locations with high crash rates and other key intersections and corridors are not necessarily being monitored.
- Sophisticated traffic volume prediction algorithms based on archived and actual conditions do not exist in the Region.

### **Ports/Military Impacts:**

- The impacts that Norfolk Naval Base has on Regional transportation operations has not be assessed, both at the gates and on-base.
- There is limited coordination and work with Norfolk Naval Base Public Works to develop central control of signals and gates at Base.
- Signal timings are not adjusted to be responsive to Base traffic.
- Note: Naval Base signals are all in free operation; not coordinated and not corridor-based. Also, the Naval Base, to date, has not been able to implement a parking, channeling, or transit-oriented plan.
- Parking issues on the Naval Base often results in traffic impacts from base.

### **Monitoring Weather Conditions:**

- Roadways or sections of roadways for specific conditions, e.g., icing or flooding, are not always monitored.

### **Enforcement**

#### **Overheight Vehicles:**

- The impacts of on-going efforts are not always understood:
  - VPA is installing an over-height sensor at terminals that will furnish drivers with

## **Enforcement**

- a direct read-out of vehicle/container height.
- The Region does not necessarily know:
  - Who owns/operates the vehicles that are being turned back?
  - What types of vehicle are turned back?
  - What industries are represented by the over-height vehicles?
  - Can the vehicles' USDOT Numbers or DMV Registration be used in studying the issues?
  - What information is the VSP capturing when turning back vehicles?

## **Automated Red-Light Running Enforcement:**

- Most jurisdictions in the Region, at present, are legislatively prohibited from implementing red light running.
- Impact that automated enforcement would have on crash rates and congestion at key intersections have not been examined.

## **HOV Enforcement:**

- HOV-lane lanes often include several violators. The Region needs to do a better job of monitoring and enforcing HOV-lanes. The Region should examine innovative technologies for HOV enforcement, particularly as they relate to determining total vehicle occupants.

## **Education**

### **Staff and Public Training:**

- As new systems are developed and deployed, leaving operational procedures outdated and staff untrained.
- The public is uneducated on the general role of ITS.

### **Leadership Training:**

- The region does not fully understand how best to institutionalize strategies.
- Executives are not educated on the significance of systems management and the role of ITS.
- Political champions do not exist or are not active in the Region.

**Program Area: Systems Management**

<b>Operational Coordination</b>
<b>Coordination:</b> <ul style="list-style-type: none"><li>▪ There is limited operational consistency in the Region.</li><li>▪ The Region lacks region-wide requirements and standards for data-processing.</li><li>▪ Operational agreements through agency and jurisdictional are not fully defined and maybe outdated. Informal agreements today should give way to formal agreements tomorrow.</li><li>▪ There is a lack of consistent curfews across jurisdictions during emergencies and lack of intersection control during signal outages.</li><li>▪ There are not set standards for Regional incident management/emergency management.</li></ul>
<b>Evolving Roles and Responsibilities:</b> <ul style="list-style-type: none"><li>▪ Day-to-day operational roles and responsibilities throughout region, including: during incidents, diversion routes, purchasing efforts, information sharing, etc. are unclear.</li></ul>
<b>Ports/Military Coordination:</b> <ul style="list-style-type: none"><li>▪ There is limited ongoing interaction between transportation community and military, ports, and freight interests in Region.</li><li>▪ Water-related operations on the Regional surface transportation system have not been fully assessed – e.g., bridge raisings for ships.</li><li>▪ The level of ship presence directly impacts arterial operations.<ul style="list-style-type: none"><li>○ This could potentially necessitate the need for limited access to “classified” information and/or more adaptive/responsive systems.</li><li>○ For example: when an aircraft carrier returns to Hampton Roads, estimated 5,000-10,000 people/trips almost instantly occur.</li></ul></li><li>▪ Bridge raisings are not coordinated with 911 dispatch centers. Sending emergency vehicles to raised bridges is a critical problem.</li><li>▪ Dispatchers do not always know the best routes to send vehicles given real-time system conditions.</li><li>▪ Jurisdictions do not have bridge information.</li><li>▪ Road closure information that is collected by VDOT is not being disseminated to those who need access to it.</li></ul>
<b>HRT and Roadway Stakeholders:</b> <ul style="list-style-type: none"><li>▪ There is limited communication/coordination between jurisdictions, VDOT, and HRT.</li><li>▪ School service and curfew information is not being channeled to HRT during periods of disrupted service.</li><li>▪ Operational synergies among HRT, VDOT and municipalities and work to leverage investments and data collected are not fully understood.</li></ul>

<b>Communications Infrastructure</b>
<b>Evolving Communications:</b> <ul style="list-style-type: none"><li>▪ There is a lack of a fully interoperable communications infrastructure.</li><li>▪ Interagency communications throughout Region is not being performed.</li><li>▪ Key stakeholders do not have access to daily operational information, including, incident and traffic management data.</li><li>▪ Regional communications needs have not been completely defined.</li><li>▪ Communications resources have not been defined that can be shared regionally between VDOT STC, HRT, and jurisdictional STC's.</li></ul>

## Communications Infrastructure

### **Hardening Communications:**

- Communications, particularly aboveground hubs, need to be hardened.
- Innovative solutions for back-up to communications outages do not exist in the region.
- Harden communications to field devices; when communications are down, remote polling and monitoring of field equipment is not possible.

### **Radio-Based Communications:**

- HRT requires a robust radio-based communications platform for CAD/AVL. (Use of a cellular system is not preferred.)
- The Regional radio systems and the utility of the regional communications group are not fully understood.

## Planning

### **VDOT's Role in Systems Management:**

- The role of the VDOT STC for systems management in the Hampton Roads Region has not been defined.

### **Future Freight Movements:**

- There has been little effort to reach out to private freight stakeholders and understand the key issues associated with freight fleet management.
- The impacts of new e-commerce type markets on the Region's freeways and arterials have not been assessed.

## System Monitoring and Performance

### **Systems Management Performance:**

- Regional ITS equipment and systems that are growing in application and coverage are not necessarily supported.
- Planning does not always account for both for the implementation of original software and the deployment of major software upgrades.
  - The effective life of most software systems is 7-10 years.
  - Much of the software and equipment will need to be upgraded or replaced at least once during the period of performance covered by the 2026 Plan.

### **Water Transportation and Ship Movement:**

- The USCG is not able to link to Regional information outlets for system management.

### **Freight Movement:**

- Rail and freight have a significant impact on system performance.
- Over-height vehicles are often being turned around at tunnels.
- Vehicles transporting hazardous materials are not always easily identified. They need to be diverted out of mainstream traffic, screened, and returned to traffic without causing major impact on the flow of traffic.

### **Performance Measures:**

- The Region has not adopted performance measures to evaluate system and operations.
- The Region does not have a full grasp of available and archived data.
- The Region does not utilize available data and share it among stakeholders. There are several gaps and critical deficiencies in data.

## **Education**

### **Staff Training:**

- As new systems are developed and deployed, leaving operational procedures outdated and staff untrained.

### **Leadership Training:**

- The region does not fully understand how best to institutionalize strategies.
- Executives are not educated on the significance of systems management and the role of ITS.
- Political champions do not exist or are not active in the Region.

**Program Area: *Traveler Information***

<b>Operational Coordination</b>
<b>“Pushing” Traveler Information to Customers:</b> <ul style="list-style-type: none"><li>▪ The Region does not fully comprehend the available data and “push” useful information to customers.</li><li>▪ Traveler information is not always provided in a reliable and timely manner to the public.</li><li>▪ Traveler information is not tailored to highway users, transit users, commercial drivers, ports and military stakeholders, and tourists.</li></ul>
<b>Traveler Information During Emergencies:</b> <ul style="list-style-type: none"><li>▪ The Region does not effectively generate timely information about road, traffic, and weather conditions; traffic diversion guidance; etc.</li><li>▪ Transportation information during emergency recovery stages is not robust.</li><li>▪ The media’s role during emergencies needs to be explored. The Region may wish to designate one or more media outlets as authoritative source of traveler information.</li></ul>
<b>Traveler Information at Ports and for CVO:</b> <ul style="list-style-type: none"><li>▪ There is little work being done with Ports to provide traveler information for truckers navigating the Regional transportation network.</li><li>▪ The type of information suitable for truckers, e.g., data that assists them in making route choices needs to be assessed.</li></ul>
<b>Important Region-Wide Information:</b> <ul style="list-style-type: none"><li>▪ Information needs to be disseminated on Regional bridge lifts, including information for Coleman, James River, High-rise, Berkeley, and other bridges currently operated by the Army Corp of Engineers.</li><li>▪ Tunnel status information needs to be disseminated.</li><li>▪ Data is not always provided in a timely manner and disseminated properly.</li></ul>
<b>Planning and Executing Regional ATIS and 511</b>
<b>VDOT Statewide 511 &amp; Regional ATIS:</b> <ul style="list-style-type: none"><li>▪ The Region does not have Regional traffic channels on radio and TV.</li><li>▪ The role of the public and private sectors in providing traveler information has not been determined.</li><li>▪ The Region needs to understand VDOT statewide 511 efforts and define pertinent requirements for Regional service.</li><li>▪ The Region does not necessarily understand:<ul style="list-style-type: none"><li>○ Where the opportunities to enhance dissemination exist today and in the future,</li><li>○ The media’s role in ATIS, and</li><li>○ The costs and benefits of a Regional ATIS station.</li></ul></li></ul>
<b>Regional HAR:</b> <ul style="list-style-type: none"><li>▪ HAR is not perceived by many Regional travelers as highly useful because of its limited broadcast range and a dearth of timely, relevant, and consistent information.</li><li>▪ HAR investments have been made, including transmitters and roadside signage; however, broadcast messages tend not to be up-to-date and often include inadequate information for travelers to make informed decisions about alternative routing, etc.</li><li>▪ The HAR systems have become outdated and may need to serve larger areas.</li><li>▪ The role of HAR in a Regional 511 program is not fully understood.</li></ul>

## Planning and Executing Regional ATIS and 511

### **Regional ATIS Website:**

- The Region lacks a common transportation information website for traveler information.
- The Region has not agreed on what will be presented (e.g., work zones, incidents, emergency information, evacuation routes, etc.) and how to scale down to the municipal level.
- Travelers do not have a one-stop website. They should not have to go to different websites (e.g., municipal, HRT, VDOT, and/or media sites) to obtain a comprehensive “picture” of transportation conditions in the Region.
- Investigation into how the Regional website will link to 511 and other ATIS outlets has not taken place.

### **ATIS and the Customer:**

- Transit information is not readily accessible to customers through ATIS.
- The Region does not have systems to enable customers to obtain accurate, real-time schedule information on the status of buses, etc.

## Communications Infrastructure

### **ATIS-Enabling Communications:**

- The VDOT backbone to enable ATIS data and video-sharing among agencies is not complete.
- 511 infrastructures and phone company agreements have not been assed in the Region.

## Education

### **Public Training:**

- Consumers are not properly educated on the range of traveler information available to them and how to access it.

### **Leadership Training:**

- The region does not fully understand how best to institutionalize strategies.
- Executives are not educated on the significance of systems management and the role of ITS.

**Program Area: *Program Development & Management***

**Planning and Executing Program Development & Management**

**Regional ITS Program Needs:**

- There is a lack of secured necessary funding for required staff to operate and maintain Regional operations centers.
- Relationships need to be better cultivated with elected officials, government agency program managers, information officers, etc. who can potentially help “champion” the Region’s ITS program.
- MOU’s have not been identified and prioritized that will support and expand the Region’s ITS program.
- The general public is uneducated about ITS and identify, cultivate, and engage high-level champions.
- There are not any Regional standards to facilitate interoperable systems and integration, and data-exchange among agencies.
- Develop new procurement methods for ITS projects; this should include joint equipment procurements.
- Strategies ITS decision-making and program implementation are often slow.

**Education**

**Staff and Public Training:**

- Staff and the general public are often uneducated on the benefits of ITS and enhanced operations.
- The Region can do a better job of marketing the benefits of operational services.

**Leadership Training:**

- Champions do not realize the importance and role of ITS activities.
- Non-transportation stakeholders do not fully understand the impacts that transportation activities have on the quality-of-life across the Region.
- ITS champions have not been cultivated.