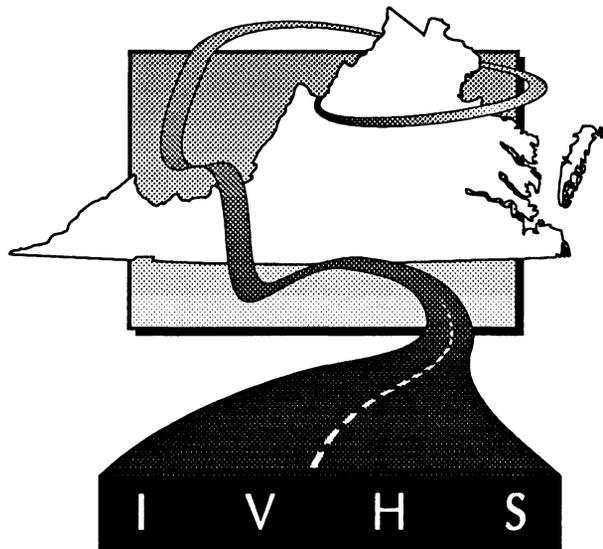


TECHNICAL ASSISTANCE  
REPORT

INTELLIGENT VEHICLE-HIGHWAY SYSTEM  
(IVHS) ACTIVITIES  
IN THE VIRGINIA  
DEPARTMENT OF TRANSPORTATION



BRIAN SMITH  
Research Scientist



**TECHNICAL ASSISTANCE REPORT**  
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**IN THE VIRGINIA DEPARTMENT OF TRANSPORTATION**

**Brian Smith**  
**Research Scientist**

(The opinions, findings, and conclusions expressed in this  
report are those of the author and not necessarily  
those of the sponsoring agencies.)

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**INTELLIGENT VEHICLE-HIGHWAY SYSTEM  
(IVHS) ACTIVITIES  
IN THE VIRGINIA DEPARTMENT OF TRANSPORTATION**

Intelligent Vehicle-Highway Systems (IVHS) promise to improve the safety and efficiency of Virginia's transportation network through the application of emerging technology. For many years, the Virginia Department of Transportation (VDOT) has been a leader in the application of advanced transportation technology. This leadership is continuing as VDOT plays a key role in the national effort to advance IVHS.

VDOT is currently active in IVHS research, development, and deployment. In addition, the department is active in all areas of the field, from Advanced Traffic Management Systems (ATMS) to Advanced Vehicle Control Systems (AVCS). The following is a summary of VDOT's activities in the field of IVHS. In addition to these IVHS activities, an effort is underway to synthesize Virginia's various components into a comprehensive IVHS program.

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**PROJECT:** I-66/I-95/I-395 Traffic Management System

**LOCATION:** Northern Virginia

**CONTACT:** Jimmy Chu  
Traffic Management System Manager  
Virginia Department of Transportation  
1426 Columbia Pike  
Arlington, VA 22204 Phone: (703) 521-5695

**PROJECT DESCRIPTION:**

The traffic management system (TMS) monitors a 10-mile stretch of I-66 between the Capital Beltway (I-495) and the Roosevelt Bridge, an 11.5-mile segment of the Shirley Highway (I-395) between I-495 and the 14th Street Bridge, and 10 miles of the Capital Beltway (I-95) in the area of the Woodrow Wilson Bridge. The TMS is staffed with 5 operators and 2 supervisors for 16 hours a day, 7 days a week, at the TMS center in Arlington.

Northern Virginia's TMS has many of the capabilities and features that define the IVHS functional area, Advanced Traffic Management Systems (ATMS). The primary responsibility of the TMS is incident management. Loop detectors are installed throughout the system at 1/2-mile spacings (550 total) to monitor traffic flow and detect incidents. Closed circuit television (CCTV) is utilized to verify detected incidents and aid in incident management. A total of 48 CCTVs are installed in the TMS.

Another responsibility of the TMS is to provide congestion management. Twenty-six ramp meters are stationed throughout the network to regulate traffic flow onto the interstates during peak periods. In addition, 100 variable message signs are used to provide travelers with information concerning network conditions. These signs provide information such as high occupancy vehicle (HOV) restrictions, openings/closings of the reversible lanes on I-395, and freeway conditions (accidents, congestion, etc.).

An area that is given high priority in the TMS is one of the region's major bottlenecks, the Woodrow Wilson Bridge. Nine CCTVs are used to monitor traffic conditions in the area of the bridge, and 22 variable message signs are used to pass on information to the traveler. This bridge surveillance activity is coordinated with the state of Maryland.

Finally, there are plans to expand the system significantly in the near future. As the HOV facilities of I-95 and I-66 are extended, additional CCTVs, ramp meters, and variable message signs will be added to the system. In addition, it is expected that a number of IVHS projects proposed for the region will depend upon integration with the TMS.

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**STATUS:**            The TMS was implemented in 1985 and is now fully operational.

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**PROJECT:** Suffolk District Tunnel Traffic Management Systems

**LOCATION:** Tidewater Region

**CONTACT:** Wayne White  
District Tunnels & Toll Engineer  
Virginia Department of Transportation  
P.O. Box 3447  
Hampton, VA 23663 Phone: (804) 727-4811

**PROJECT DESCRIPTION:**

Traffic control and surveillance systems are currently being used on three major tunnels in the Tidewater region: the Hampton Roads Bridge-Tunnel (I-64), the Downtown Tunnel (I-264), and the Monitor-Merrimac Memorial Bridge-Tunnel (I-664). These systems monitor traffic using CCTVs and vehicle detector loops. Traffic information is relayed to a central computer, where incident detection software is utilized. In addition, the systems use variable message signs to communicate conditions to the traveler.

The Hampton Roads Bridge-Tunnel and the Monitor-Merrimac Memorial Bridge-Tunnel use a highway advisory radio (HAR) system to inform travelers further of traffic conditions. Six transmitters are situated around the area in advance of major route diversion points. The HAR advises motorists of possible delays and suggests alternate routing choices.

Finally, a major enhancement of the current traffic information telephone service is being studied. This service will allow travelers in the area to obtain current traffic information about the tunnels (as well as other transportation facilities in the region) by calling an automated telephone information system. The service will be updated at 15-minute intervals.

**STATUS:** The surveillance systems and HAR are operational. Proposals are presently being considered for the new telephone service.

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**PROJECT:** Commercial Vehicle Operations (CVO) Development

**LOCATION:** Statewide

**CONTACT:** Jim Robinson  
Transportation Engineering Programs Supervisor  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-2878

**PROJECT DESCRIPTION:**

Virginia has been an active participant in CVO development in a number of ways. For example, VDOT is currently participating in a pooled research project with other FHWA Region III states to determine institutional barriers that would impede the implementation of interstate CVO systems. Virginia is also participating in the FHWA Region IV institutional issues study as well. This is seen as the first step to develop CVO in the I-95 corridor, with Virginia serving as the "bridge" state. It is anticipated that this research will improve the efficiency of commerce in the major interstate corridors.

Another example of Virginia's activity in CVO is the Commonwealth's efforts in the research and development of Weigh-In-Motion (WIM) systems. The Virginia Transportation Research Council has conducted a study comparing a number of WIM systems. In addition, VDOT has installed permanent WIM sites throughout the Commonwealth to provide data for the Long-Term Pavement Performance Project as part of the Strategic Highway Research Program (SHRP).

Finally, Virginia has been a long-time participant in the national HELP program. Within HELP, the Commonwealth has been particularly active in the development of automatic vehicle identification (AVI) systems. This participation has included being a member of the AVI subcommittee, as well as executing field tests of AVI systems.

**STATUS:** This is an ongoing activity within VDOT.

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**PROJECT:** Video Imaging Detection System

**LOCATION:** Northern Virginia

**CONTACTS:** Jimmy Chu  
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Virginia Department of Transportation  
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1401 East Broad Street  
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**PROJECT DESCRIPTION:**

The purpose of this IVHS operational test is to evaluate the capabilities of a video imaging detection system (VIDS). The AUTOSCOPE system, which was chosen for evaluation, consists of a standard video camera, a microprocessor, and image processing software. Video images are analyzed using the software in order to estimate traffic flow characteristics. The primary focus of this project will be to evaluate the incident detection capabilities of a VIDS. In addition, the project will analyze the system's accuracy in monitoring traffic. This research will aid in assessing the value of using VIDS as sensors in IVHS.

Two cameras have been installed for use in this project. One camera monitors southbound traffic on the Woodrow Wilson Bridge, and the other camera monitors northbound traffic at the Telegraph Road interchange with I-95 (the Capital Beltway), approximately 1.5 miles south of the Woodrow Wilson Bridge. Furthermore, loop detectors are in place at these locations to allow for comparison of the system's detection capabilities.

**STATUS:** The AUTOSCOPE software is currently being updated. A six-month demonstration period is expected to begin in July 1992.

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**PROJECT:** Airborne Video System

**LOCATION:** Northern Virginia

**CONTACTS:** Jimmy Chu  
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Virginia Department of Transportation  
1426 Columbia Pike  
Arlington, VA 22204 Phone: (703) 521-5695

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MPO A.J. Neville  
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3911 Woodburn Road  
Annandale, VA 22003 Phone: (703) 280-0558

**PROJECT DESCRIPTION:**

The airborne video system utilizes a video camera mounted to a helicopter to provide a mobile video platform for use in traffic management. The system will supplement fixed surveillance CCTVs with real-time information concerning traffic incidents.

It is expected that the use of real-time airborne video will serve as a valuable component of an ATMS, particularly in incident management. The video information will provide a control center with the type, location, severity, and impact of an incident. This project, an IVHS operational test, will address three major objectives:

1. Determine capabilities and limitations of a remotely controlled gyro-stabilized camera.
2. Establish the effectiveness and reliability of a video link between a helicopter and a ground station and between a ground station and a traffic management center.
3. Evaluate the effectiveness and applications of real-time video for an ATMS.

In addition to the evaluation period of the first phase of this project, future phases will examine the transfer of information between jurisdictions for regional ATMS applications. Many of the institutional issues that have been identified as key to the success of IVHS will be considered in this phase.

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**STATUS:** Fairfax County is currently evaluating video equipment. It is expected that the system evaluation will begin by September 1992.

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**PROJECT:** Highway Surveillance Television Broadcast

**LOCATION:** Northern Virginia

**CONTACTS:** Jimmy Chu  
Traffic Management System Manager  
Virginia Department of Transportation  
1426 Columbia Pike  
Arlington, VA 22204 Phone: (703) 521-5695

Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-6777

**PROJECT DESCRIPTION:**

This system will allow local television stations to broadcast video from the CCTVs of the Northern Virginia TMS. The stations wish to use this video to supplement area traffic reports. For example, rather than simply stating the location of an incident, the station could also include a live transmission from the scene. This system will serve to inform the traveler better of the status of the transportation network.

It is anticipated that this system could be expanded to provide video feeds to information kiosks at major activity centers, such as shopping malls. A traveler could access up-to-date traffic information at the kiosk and plan an appropriate route.

**STATUS:** VDOT is currently developing an agreement with local television stations and examining methods for providing the video feed.

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**PROJECT:** Northern Virginia Traffic Signal System

**LOCATION:** Northern Virginia

**CONTACTS:** Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-6777

**PROJECT DESCRIPTION:**

The Northern Virginia traffic signal system will operate 450 signals with expansion capabilities to at least 1,000 signals. This state-of-the-art system will allow for signal adjustments necessitated by traffic conditions and for a central monitoring location to alter timing plans. Furthermore, this flexible system will accommodate changes in the street system, traffic demand, and control strategies.

It is expected that this system will play a major role in a future regional ATMS. In fact, there have been provisions in the design of the system to allow it to exchange information with the present Northern Virginia TMS. Preliminary studies of the signal system suggest that it will reduce total delay between 14 and 27 percent, total stops between 21 and 23 percent, and total travel time between 8 and 13 percent.

**STATUS:** The system design is currently being updated. Advertisement for the system is tentatively scheduled for the fall of 1992.

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**PROJECT:** FASTOLL

**LOCATION:** Dulles Toll Road - Northern Virginia

**CONTACTS:** Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-6777

**PROJECT DESCRIPTION:**

FASTOLL is an integrated toll collection system that has been designed to replace the existing standard manual system on the Dulles Toll Road. Although FASTOLL will continue to use both manual toll collection and automatic coin collection machines, it will also utilize a toll collection system based on automatic vehicle identification (AVI). The AVI system consists of three functional elements: a vehicle mounted transponder (or tag), a roadside reader unit, and a computer system for data processing. FASTOLL will allow drivers to pay their tolls by deducting them from prepaid accounts as their tags are read. AVI-equipped vehicles will not need to stop as their tags are read, thus increasing the efficiency of the toll collection process.

There are a number of advantages expected from FASTOLL. First, the system will eliminate the delays caused by traditional toll booths, thereby increasing the highway capacity. Second, it will free personnel from the monotonous and hazardous task of collecting tolls. Finally, FASTOLL includes a new accounting system that should provide greater accuracy than the present system.

The experience gained with AVI through the FASTOLL system will be valuable in preparing for future applications of this technology. For example, it is intended that the design of FASTOLL be adaptable for future tolling applications throughout the Commonwealth. Furthermore, data obtained with AVI, such as travel times, may prove valuable in future transportation planning efforts.

**STATUS:** VDOT is currently considering contractor proposals for the system.

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**PROJECT:** University Road Connection - "Smart Highway"

**LOCATION:** Blacksburg/Roanoke, Virginia

**CONTACTS:** Antoine Hobeika  
Director  
Virginia Polytechnic Institute and State University  
Center for Transportation Research  
106 Faculty Street  
Blacksburg, VA 24061 Phone: (703) 231-7740

David Gehr  
Assistant Commissioner for Operations  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-2711

**PROJECT DESCRIPTION:**

The "smart highway" will be a 6-mile route connecting the Blacksburg and Roanoke areas, constructed primarily to serve in the demonstration, evaluation, and testing of IVHS technologies. This will be the first IVHS facility built from the ground up in the United States. This is advantageous in that the various sensors and communications media (such as fiber optic cable) can be designed to function as an integral component of the system. In addition, this project will provide a unique opportunity to examine the application of IVHS in intercity transportation.

It is anticipated that this facility will be used to look at the more advanced aspects of IVHS, in addition to employing a combination of ATMS, traveler information systems, and CVO. The development of safety enhancement systems will be a primary objective. There has been interest expressed by major automakers to utilize the facility as a test-bed for their electronic safety systems, such as all weather/night vision devices.

Finally, the IVHS research in this region is expected to extend beyond the smart highway. An "IVHS Research Triangle" has been identified that will utilize the new facility, along with existing stretches of U.S. 460 and Interstate 81 to conduct research into all aspects of IVHS. The new smart highway will be used to examine Advanced Traveler Information Systems (ATIS). It is expected that U.S. 460, a congested, urban facility, will be used to look into the ATMS area. Finally, the mountainous terrain, frequent inclement weather, and high percentage of truck traffic on I-81 in this region make it ideal to use in conducting research into safety and Commercial Vehicle Operations (CVO).

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**STATUS:**            The project is undergoing conceptual development (allocated \$5.9 million in 1991 ISTEA).

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**PROJECT:** I-64 Traffic Management System

**LOCATION:** Hampton Roads Area

**CONTACTS:** Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-6777

**PROJECT DESCRIPTION:**

The I-64 TMS will consist of a complete traffic surveillance, control, and management system for the reversible bus and HOV roadway being constructed in the median of I-64 between I-564 and I-264/VA-44, an 8-mile section. In addition, this system will encompass I-64 concurrent flow HOV lanes on a 4-mile section from the I-264/VA-44 interchange to Indian River Road, as well as a 4-mile section on VA-44. Furthermore, the system will accommodate upgrades to allow for management of the entire freeway system in the region.

In many ways, the I-64 TMS is similar to the Northern Virginia TMS. As in Northern Virginia, the I-64 TMS will rely heavily on loop detectors, CCTVs, and variable message signs. In addition, incident detection and management of the HOV facilities will be primary functions of the TMS. Finally, the system is expected to serve as a foundation for further IVHS developments in the region.

An interesting area of concentration of the I-64 TMS will be in traffic diversion. Given the often congested conditions of the tunnels and bridges in the region, strategies to divert travelers to other crossing points will be critical. A number of variable message signs will be dedicated as point diversion signs for the sole purpose of encouraging alternate routes.

The I-64 TMS will face a major challenge in interfacing with other management systems already in place in the region. Many cities in the area, as well as the major tunnels, have developed and implemented independent traffic control systems. In coordinating these various systems, a number of institutional problems need to be addressed.

**STATUS:** Plans for the system are nearly completed. Construction is scheduled for January 1993.

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**PROJECT:** Hampton Roads IVHS Program

**LOCATION:** Tidewater Region

**CONTACTS:** Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219

Phone: (804) 786-6777

**PROJECT DESCRIPTION:**

VDOT has taken the lead, along with the cities of the Hampton Roads region and various transportation-oriented groups, in examining the opportunities to implement a comprehensive IVHS program in the region. It is felt that the unique characteristics of the region, including the large number of tourists and a high concentration of military personnel, make Hampton Roads an ideal location to examine both ATMS and ATIS.

This project will take advantage of the existing resources of the region. The tunnel management centers, HAR, I-64 TMS, and signal control systems for the Hampton Roads cities will serve as a basis for the program. As these resources are incorporated into the regional program, and new capabilities are added, a true IVHS program will result. Finally, given the difficult transportation problems of the region, the performance of such an IVHS program will give an indication as to the potential of IVHS to the nation.

**STATUS:** A funding proposal for FHWA is being prepared.

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**PROJECT:** Dulles Area Traveler Information System (DATIS)

**LOCATION:** Northern Virginia

**CONTACTS:** Edward Byrne  
Executive Director  
Dulles Area Transportation Association  
13873 Park Center Road  
Herndon, VA 22071 Phone: (703) 689-9589

Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-6777

Jimmy Chu  
Traffic Management System Manager  
Virginia Department of Transportation  
1426 Columbia Pike  
Arlington, VA 22204 Phone: (703) 521-5695

**PROJECT DESCRIPTION:**

The Dulles Area Transportation Association (DATA), a joint public-private organization, is currently developing DATIS, an ATIS for the heavily congested Dulles corridor. DATIS will utilize advanced methods of collecting, interpreting, conveying, and displaying data to provide real-time information about road and traffic conditions, highway incidents, construction detours, service delays on Metrorail, parking availability at Park-and-Ride, airport and Metrorail parking lots, and other information necessary to make intelligent travel decisions. Of course, the ultimate goal of DATIS is to relieve congestion and improve mobility in the corridor. The two major tasks of the DATIS project are:

1. Develop a plan for an operational field test of DATIS. This includes a recommended implementation plan, a cost estimate, an assessment of potential private sector roles, and a proposed organizational framework.
2. Assess the commercial market potential and the necessary interagency coordination for deploying DATIS.

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**STATUS:**

DATA is currently preparing a design report detailing the first phase of the study. In addition, DATA is developing a proposal to implement the system as an operational test for the FHWA.

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**PROJECT:** Highway Advisory Radio

**LOCATION:** Northern Virginia

**CONTACTS:** Ron Minor  
Major  
Fairfax County Police Department  
3911 Woodburn Road  
Annandale, VA 22003 Phone: (703) 280-0500

Kenneth Wester  
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Virginia Department of Transportation  
3975 Fair Ridge Drive  
Fairfax, VA 22033 Phone: (703) 934-7317

**PROJECT DESCRIPTION:**

Highway Advisory Radio (HAR) can be considered a first generation ATIS. Using a radio broadcasting system, HAR allows for real-time highway network information to be presented to the traveler. Fairfax County and VDOT is planning to use HAR on a regional basis in Northern Virginia as a significant element in the traffic management effort. There are two primary goals for the HAR system:

- Goal 1 To reduce accidents by forewarning motorists of unusual conditions on the network.
- Goal 2 To reduce motorist travel times and congestion near incident sites by providing enough information so that motorists can make informed routing decisions.

It is anticipated that an initial HAR system, which will consist of 3 fixed and 1 portable broadcast sites, will provide information about the following:

1. Major traffic incidents (i.e., road closure)
2. Accidents resulting in traffic flow disruption
3. Woodrow Wilson Bridge openings
4. Inclement weather closures / road conditions
5. Daily maintenance operations
6. Construction projects

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**STATUS:**

Fairfax County has received a temporary permit from the FCC and is awaiting shipment of broadcast equipment to begin a testing phase.

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**PROJECT:** I-95 Priority Corridor Coalition

**LOCATION:** I-95 Corridor: Petersburg, Virginia - Portland, Maine

**CONTACTS:** Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-6777

**PROJECT DESCRIPTION:**

The I-95 Priority Corridor Program will use IVHS technology to improve travel on the I-95 corridor, from Petersburg, Virginia, to Portland, Maine. It is intended that this highly urban and multimodal corridor will become a showcase for IVHS technologies. The program will focus on examining IVHS institutional issues, developing multistate traffic management systems, and developing interregional ATIS.

The program will be designated as a "priority corridor" within the Federal Highway Administration's IVHS Corridors Program. This program, created by ISTEA, will provide substantial support for the I-95 Priority Corridor Coalition. VDOT is a member of the coalition and is actively participating in the initial planning effort.

**STATUS:** The Coalition is in the early planning stages for this program.

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**PROJECT:** Baltimore-Washington Metropolitan Region IVHS Program

**LOCATION:** Northern Virginia

**CONTACTS:** Charles Hall  
Assistant State Traffic Engineer  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, VA 23219 Phone: (804) 786-6777

**PROJECT DESCRIPTION:**

Virginia is working with an IVHS planning committee for the Baltimore-Washington area. This group is looking at ways to utilize IVHS to improve traffic on the congested transportation system of the region. The focus of this plan is specifically on ATMS and ATIS applications in the region.

**STATUS:** The committee is currently developing a proposal for the system.