EXECUTIVE SUMMARY

“Virginia ADMS” (Archived Data Management System) is an operational test designed to develop and demonstrate applications of archived data collected by intelligent transportation systems (ITS). This 18-month program, scheduled for completion in June 2004, has already produced an operational system that is making a significant impact by providing easy access to data and analytical tools that support activities such as:

- Planning for operations
- Incident management
- Regional planning
- Air-quality modeling
- Special event planning
- Performance measurement

As stated by the FHWA contract technical lead, Dale Thompson, “Virginia ADMS is leading the way to demonstrate the full value of ITS data – providing further evidence of the tangible benefits realized by regions from ITS investments.” The success of Virginia ADMS has been made possible through an innovative public/private/academic partnership, leading-edge research to support advanced ADMS functions, utilization of emerging industry and ITS standards, and careful attention to best practices in systems and software engineering.
HOW VIRGINIA ADMS WORKS

Traditionally, ITS deployments collect large quantities of data using devices such as inductive loop detectors, automatic vehicle identification (AVI) tags and readers, and video systems, to support real-time system management and information dissemination. In the past, once the real-time functions were complete, the data was largely unused. The purpose of Virginia ADMS, an implementation of the archived data user service (ADUS) defined in the National ITS Architecture, is to retain this data, subject to strict quality control standards, and make the data, along with associated analytical tools, available to transportation professionals to support a host of applications. The design philosophy used in Virginia ADMS is to apply concepts of “data warehousing” to create a system that effectively supports improved decision-making for the stakeholders.

The current version of Virginia ADMS focuses on the Hampton Roads region of the state. Hampton Roads is a large urban region that is the home to the Norfolk Naval Base - the largest naval base in the nation, numerous other large military installations, a nationally known beach resort district, and an active commercial port. Virginia ADMS incorporates ITS data from the following systems:

- VDOT’s Hampton Roads Smart Traffic Center (regional freeway management system)
- City of Norfolk’s Traffic Signal System
- Hampton Roads Transit Routing and Scheduling System
- VDOT’s Traffic Counts program
- Weather Stations
- Regional Transportation Planning Models (from the Hampton Roads Planning District Commission)

This data is made available to users through an innovative web-based system. As a result of this design, a user from any location or organization can readily gain access to the system with simply a web browser and internet connection. The system includes modules tailored for specific users of the system, and also incorporates advanced web-based geographic information systems (GIS) capabilities.

While Virginia ADMS is currently focused in Hampton Roads, it has been designed to allow for statewide expansion. As stated by J.R. Robinson, VDOT’s ITS Director, “The benefits that we are already seeing from the use of Virginia ADMS in the Hampton Roads region have provided the motivation for VDOT to support an aggressive effort to expand the system statewide – providing us with the capability to truly measure mobility on a statewide basis that is unmatched in this country.”
IMPACT OF VIRGINIA ADMS

To illustrate the impact of this research program, 5 key functional capabilities of the system and how the stakeholders perceive them are discussed:

Planning for Operations

In order to effectively manage incidents, it is critical to learn from successes (and problems) from the past. Virginia ADMS allows operators to carefully examine incident time-lines, including traffic patterns and weather conditions, to improve incident management.

Stephany Hanshaw, director of the Hampton Roads Smart Traffic Center emphasizes this impact, “Virginia ADMS provides a tool to be used to optimize our incident response plans. This is a great project for us operations guys. It is a great return on investment.”

Emergency Planning & Operations

Planning for critical events and emergencies is a challenging region-wide activity. Virginia ADMS improves emergency planning by providing comprehensive data to a wide user community, and by directly incorporating experience learned from previous events.

John Yorks, Traffic Engineer in the City of Hampton, relates this impact as follows: “Our goals for the city’s signal control system include developing timing plans for both planned and unplanned traffic events including concerts, holiday traffic, sporting events, hurricane evacuations, interstate incidents, college graduations, work zones, etc. Having a library of real data from VDOT and other localities at our fingertips is invaluable in developing plans for special events which impact both City and VDOT facilities.”

Regional Planning

One of the problems that have traditionally plagued effective regional transportation planning is the lack of quality data. Virginia ADMS has made an immediate impact on planning in Hampton Roads by relating ITS data directly to the transportation planning model used in the region.

Camelia Ravanbakht, Principal Transportation Engineer of the Hampton Roads Planning District Commission expands on this impact, “As a regional planning agency, we constantly are in need of many types of traffic data on a regional level. The Hampton Roads MPO staffs use speed, volume and incident data
from Virginia ADMS to calibrate the long range transportation planning/air quality model of the region.”

**Environmental Analyses**

Transportation agencies depend on detailed air quality models to estimate the impacts of proposed improvements on the environment. Virginia ADMS supports these activities by providing tailored data formatted to directly support common air quality models.

Amy Costello, lead on the VDOT Air Quality modeling program, describes the impact of Virginia ADMS on her activities, “For the first time in Virginia, the ADMS system provides the customer with instant real-time and archived traffic data from several systems. This quick, easy to use, reliable data source not only greatly improves access to quality data, but also saves time and makes it easier to obtain real data in a usable format.”

**Performance Measurement**

Finally, as transportation agencies move to a focus on operations, it is essential that mobility performance measures are available to directly measure congestion and the quality of travel. Virginia ADMS directly computes a number of mobility performance measures, allowing users to investigate these measures for locations and times of their choosing.

Again, VDOT’s Stephany Hanshaw discussed this impact: “The immediate benefit provided by the ADMS has been internal transportation system performance analysis. This internal evaluation at the lowest level allows us to begin to determine the local benefit of ITS and traffic and congestion management strategies. ADMS gives me the tools I need to do this.”

**RESEARCH CONTRIBUTIONS OF VIRGINIA ADMS**

As a research effort, one of the key long-term impacts of Virginia ADMS is to improve the state-of-the practice in the area of the archived data user service (ADUS). Two key research contributions made possible by, and implemented within Virginia ADMS are highlighted in this section.

**Best Practices of Systems and Software Engineering Tailored for ITS**

The development of Virginia ADMS has built on the research findings of the Smart Travel Laboratory in the areas of systems and software engineering. The system development has been user-driven, based on a clearly defined concept of
operations and requirements. To make early impacts of the system tangible to users, the project team used a phased “build” approach. This approach has been very successful, leading to on-time and under-budget deployment. The impact of this is described by Barbara Skiffington, President of the project software development firm Open Roads Consulting, Inc.: “We are very pleased with the phased deployment approach adopted by the team. Two significant results are being seen. First, by providing incremental operational releases, stakeholders are able to access the application very early in the development process. This enables stakeholders to use the system and provide feedback throughout the effort resulting in a system that fits their specific needs. Secondly, open architecture development and incremental delivery of the system allowed the team to deploy the critical functionality first and build refined functionality within subsequent builds.”

**Extraction, Transformation, and Loading (ETL) of ITS Data**

A key aspect of data warehousing is to develop a sound ETL process. The purpose of this process is to identify errors in operational data, fix errors when possible, and add value to raw data that makes it more useful to analysts. The research team has developed advanced data screening algorithms, data imputation algorithms, and data characterization techniques. Advances in the ETL process are contributing directly to the on-going ITS standards development process. As stated by Shawn Turner of Texas Transportation Institute, a leader of developing ADUS standards, “Virginia ADMS is advancing the practice of data archiving by clearly demonstrating effective data management and quality principles. The system will make the "best practices" list for data archiving and should provide a wealth of information to decision-makers in Virginia.”