Intelligent Transportation Systems (ITS)
Planning Memo #2
Current and Emerging ITS Technologies

Introduction: This memo is the second in a series of three memos that Roanoke Valley-Alleghany Regional Commission (RVARC) staff will prepare for Roanoke Valley Area MPO members concerning Intelligent Transportation Systems (ITS). This memo focuses on specific ITS technologies more than memos #1 and #3, which deal with organizational, leadership and systems concepts. The primary role of the MPO is in the vision and leadership components of ITS; however, a knowledge of some current and emerging ITS technologies and how they may be applied in the area served by the MPO will help to illustrate the potential leadership role the MPO could choose to take with regards to ITS.

Image 1: "Green Light Wave" Courtesy of The Turner-Fairbank Highway Research Center USDOT **www.tfhrc.gov/pubrds/ janfeb02/timing.htm**

Background: At the September 26, 2002 MPO meeting, an overview presentation of ITS and the MPO's role in the process was given. Planning Memo #1 introduced two analogies to help describe the potential impact of ITS. The first analogy compared ITS to the impact of computers and information technology on private business, manufacturing processes and logistics systems from the mid-1980s to the present day. The second analogy introduced a perception and image that ITS can bring to a region (i.e. an image of a progressive region) that may have spillover benefits for economic development efforts. These analogies are simplifications, but they may be useful when considering the impact that different technological ITS elements can have on larger regional, community and economic goals. Planning Memo #1 also included case studies of ITS planning efforts in two other small to medium sized MPOs.

Framework: This planning memo will introduce several current and emerging ITS technologies and then discuss how they could apply to areas served by the MPO. The application of ITS strategies to specific areas of the region is a conceptual level analysis done for illustrative purposes. It does not indicate a specific commitment to fund or pursue a specific technology. A more in depth study would be necessary before such a decision could be made.

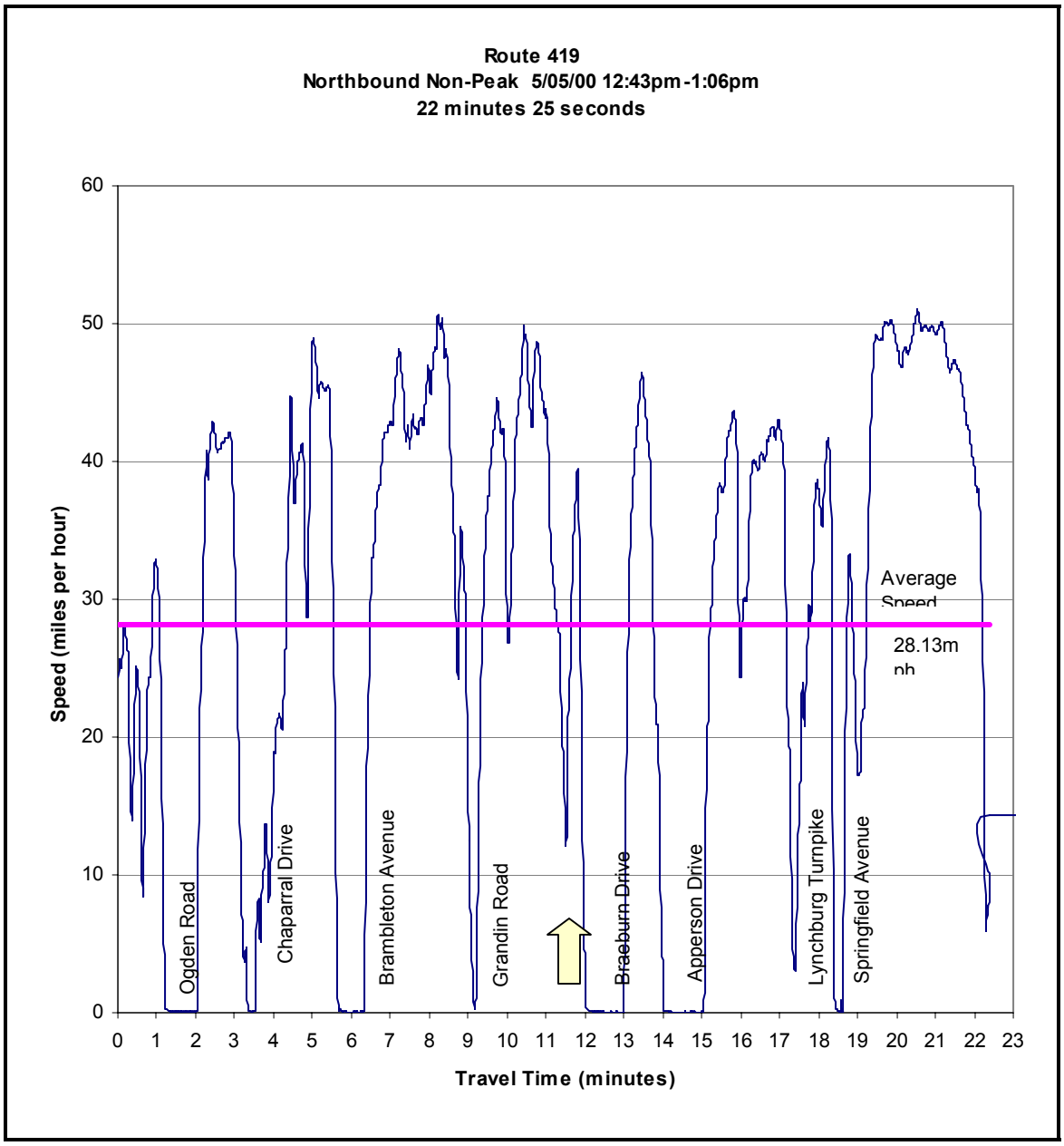
Traffic signal synchronization/ optimization: ITS strategies can be effective because they often combine several information and management tasks including: data collection, data storage, data analysis, transportation consumer information and direct system

management into one system. Traffic signal synchronization/ optimization is a popular example of such an ITS approach. Image 1 "Green Light Wave" provides a visual representation of the basic signal optimization theme. The transportation system is "managed" by granting right-of-way (green signals) to traffic on the main thoroughfare so that the traffic can maintain a steady cruising speed over large segments of the corridor. This allows for localities/regions to make the best use of current transportation assets in a similar manner as an advanced manufacturer would optimize work flows on an assembly line.

Several localities in the MPO service area already have selective implementation of traffic signal synchronization/optimization on main thoroughfares. However, there are opportunities for inter-jurisdictional traffic signal optimization on regional thoroughfares. As of the writing of this memo staff is not aware of any multi-jurisdictional traffic signal optimization agreements in the MPO service area.

In order to further develop the discussion, consider a regional thoroughfare such as Route 419 (Electric Road) in Roanoke County and the City of Salem. The City of Roanoke "Franklin Road" portion is not included in this conceptual example; however corridination with the signals on Franklin Road should yield benefits as well.

The MPO's maintains an ongoing "Global Positioning System" (GPS) travel time data collection series on regional thoroughfares; as a part of this effort, staff performed a series of travel time data collection runs on Route 419 in FY2000. An example chart from a non-peak period run is on the following page. As you can see, the test vehicle came to a complete stop at seven signalized intersections, four of which are located in Roanoke County with the remaining three in the City of Salem. The yellow arrow at the base of the chart indicates the Roanoke County/ City of Salem border. The delay experienced by the test vehicle at Braeburn Drive and Apperson Drive in the City of Salem may indicate the effects of the transition from the series of traffic signals in Roanoke County (maintained by VDOT) and the signals in the City of Salem (maintained by the City of Salem). Indeed this pattern was repeated in other travel time data collection runs on Route 419 with test vehicles traveling in both directions. For more complete information see "Travel Time Survey Pilot Study – GPS Travel Time Data Collection on the Route 419 Corridor – August 2000" and "Travel Time Survey Data Supplement – Route 419 'Electric Road' – December 2000." Both reports were prepared as a part of the FY2001 Urban Planning Work Program (UPWP).



Traffic signal optimization systems can be equipped with the ability to preempt the signal timing to allow transit or emergency vehicles to extend a green phase or to trigger a green phase as the case may be. Currently several localities in the region provide for emergency vehicle signal preemption. However transit pre-emption is not currently available in the region. The Roanoke Valley-Alleghany Regional Freight Study prepared for the RVARC and RVAMPO by Wilbur Smith Associates (FY2003 UPWP) recommends considering a large truck/ freight pre-emption signal system. The reason cited in the report indicates that a significant portion of typical start-up delay at the green phase of a signalized intersection can be explained by large tractor-trailers, which accelerate at a slower rate than typical passenger vehicles. This bottleneck effect increases delay for the lead tractor-trailer and all following vehicles. This contributes to

increased air pollution and decreased system efficiency.[1] These are some of the many opportunities for efficiency gains using ITS.

Variable Message Signs (VMSs): VMSs provide an excellent means to provide up-to-date information to the consumers (motorists and transit patrons) of transportation services, so that they can make more informed transportation decisions. VMSs can inform transportation consumers about accidents, incidents, detours, alternate routes, transit arrival times, available parking etc. VMSs often rely on similar data collection devices as traffic signal synchronization systems, however, once the data is analyzed the information is returned to the transportation consumer, rather that directly managing the system (i.e. assigning right-of-way).

Image 2: Courtesy of VDOT Richmond Construction District

According to VDOT Staff , VDOT's Salem Construction District is participating in a pilot project in which 39 Variable Message Signs will be placed on arterials and collectors at interstate intersections. These VMSs will be used to convey information to motorists relevant to traffic conditions on the interstate. In many cases traditional Highway Advisory Radio (HAR) messages will complement the VMSs.

Due to their ability to transmit information, VMSs are also useful for event planning and parking management. City of Roanoke staff is planning to use VMSs around the proposed stadium/amphitheatre. VMSs will direct vehicles to available parking and update information as parking lots are filled. VMSs will also direct transportation consumers to event shuttles and transit services.

Image 3: Courtesy of Human Performance Laboratory University of Massachusetts www.ecs.umass.edu/hpl/OLD%20WEB/ projects.html

VMSs could potentially be employed in more permanent downtown and urban area parking management strategies. As public and private parking lots and on-street parking is filled, VMSs could direct motorists to the nearest available parking. Citizens often cite a perceived lack of parking or difficulty in finding parking, when regional and/or local planners conduct visioning sessions and focus groups for

[1] "Roanoke Valley-Alleghany Regional Freight Study" RVAMPO FY2003

long-range and comprehensive planning projects. ITS techniques should go far in addressing the perceived lack of parking by providing timely relevant information.

Traveler Information – Virginia 511: VMSs can be excellent in conveying information to transportation consumers, however they have several limitations including size, sight distance, and limited message size. Even mobile VMSs can suffer from some of these limitations. Fortunately, complementary information distribution channels and strategies are evolving to provide information to transportation consumers in a comprehensive manner. Virginia 511 is essentially a public-private partnership in which major cellular phone providers, governmental entities and others have collaborated to provide travel information using cellular phones as a primary distribution channel. In fact, Virginia 511 is a facet of a more comprehensive ITS strategy which includes emergency service coordination and other elements along the I-81 corridor.

While completing research in the preparation of this memo, staff members tested Virginia 511 using their personal cellular phones. In its current form Virginia 511 uses a voice-activated search through five main sub headings: *traffic, construction, weather, road conditions and services.* The voice-activated search performs reasonably well and eliminates the need to search for buttons on a keypad. The evolution of Virginia 511 will undoubtedly incorporate more mobile distribution channels as the technology becomes available. Virginia 511 also allows the incorporation of information about services such as food, lodging and events further linking transportation with tourism and economic development.

Tying the Technology Together: The preceding examples described how traffic data is analyzed and the resulting information is either used to directly manage the transportation system or to convey information to the end-user of the system. The examples involved well-defined locations such as regional corridors, downtown parking infrastructure or special events. It is often advantageous to take a system-wide perspective that extends beyond the corridor or the central business district level. In such instances it is necessary to establish a transportation management center.

Image 4: Richmond Transportation Management Center – Courtesy of VDOT Richmond District.

A transportation management center is a central data management clearinghouse that provides for "one-stop" information services, system management and emergency and

incident response activities. As of Spring 2003, VDOT has transportation management centers located in Northern Virginia, Richmond, Hampton Roads and Fredericksburg. VDOT staff indicates that up to three transportation management centers are planned for the I-81 corridor through Virginia. VDOT staff further contends that the Salem Construction District would be the logical place for the primary transportation management center due to its central geographic location along the I-81 corridor. However, these plans have not been formalized as yet. VDOT will complete ITS plans for the I-81 corridor in 2003.

Incident Management: Incidents such as accidents and crashes can directly and dramatically disrupt the safety, operation and integrity of the transportation system and surrounding properties. Incidents are also inherently time sensitive for medical and/or public safety reasons. Traffic management centers often serve as the backbone to incident management systems. Incident management systems often rely on a methodology that includes incident detection, incident verification and corrective action. An incident management system can save lives, help protect the public health and return the transportation system to functioning capacity. The Hampton Roads District has experienced success in implementing incident management systems on selected corridors. The importance of incident management systems will likely increase as safety and homeland security concerns continue in the coming years.

Image 5: Courtesy of VDOT Smart Traffic Center, Virginia Beach, VA

Summary: There is great potential for ITS technologies to play an increasingly beneficial role in improving the performance of the regional transportation system. In addition to the data and information distribution advantages listed above, ITS strategies bring several new performance and competitive advantages not typically associated with traditional transportation improvements. The first advantage is "scalability." ITS strategies are generally well adapted to pilot testing as specific locations and expanded incrementally as resources become available. The second advantage can be summarized with the often-used buzzword "synergy." ITS strategies, such as signal optimization, can complement other approaches such as "Access Management[2]" to improve transportation system performance to a much greater extent that either approach in isolation. Finally, ITS strategies encourage an emphasis on system management and technology management concepts. The traditional Capital Improvement aspect of the transportation system will continue to be necessary, however an added emphasis of system dynamics through ITS offers much more choice in solving modern transportation problems through more efficient use of existing infrastructure.

[2] For further discussion of access management concepts, see the "Regional Access Management Study" to be completed by the end of FY2003

This report was prepared by the Roanoke Valley-Alleghany Regional Commission(RVARC) in cooperation with the U.S. Department of Transportation (USDOT), the Federal Highway Administration (FHWA), and the Virginia Department of Transportation (VDOT). The contents of this report reflect the views of the staff of the Roanoke Valley Metropolitan Planning Organization (MPO). The MPO staff is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the FHWA, VDOT, or RVARC. This report does not constitute a standard, specification, or regulation. FHWA or VDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.