Multi-Jurisdictional Transportation Telecommunications Study

for

Maryland State Highway Administration

and

Metropolitan Washington Council of Governments

June 23, 2000

Computer Sciences Corporation   **PB Farradyne**

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Executive Summary

The Metropolitan Washington Council of Governments (MWCOG) is an active leader in addressing regional issues. In the transportation arena, the MWCOG encourages leveraging the expertise of member jurisdictions and pooling of resources to develop regional systems and solutions. Given the reputation of traffic congestion in the Washington D.C. area, MWCOG is proactively involved in Intelligent Transportation Systems (ITS) projects that will have a positive impact. One such project is the Washington Area Telecommunications Study (WATS).

The scope of this project is to:

♦ Develop a detailed inventory of existing telecommunications assets utilized for ITS purposes within each MWCOG jurisdiction;

♦ Analyze the inventory to ascertain the potential for connecting the region's disparate telecommunications infrastructures;

♦ Prepare recommendations and findings as a "set of opportunities" for interconnecting networks to form larger networks, information exchange opportunities, video sharing, etc; and

♦ Document the study so that it will be useful for MWCOG jurisdictions to put forth potential projects for funding and implementation.

Computer Sciences Corporation (CSC) and its partner PB Farradyne (PBF) were contracted in August 1999 to conduct the project. To produce a meaningful report, CSC/PBF determined that an interview process with each jurisdiction would need to focus on three areas: (1) what ITS activities were being implemented by the member jurisdiction, (2) what immediate needs did the jurisdiction have for ITS data, and (3) what telecommunications assets were currently in use and planned for ITS purposes. Further details regarding the scope and methodology of the project can be found in Section 1.

Section 2 of the final report describes the state of ITS in the region and the interest in sharing of ITS data. In summary, the study found that each jurisdiction is very focused on its own ITS activities and sharing information with other jurisdictions is limited. ITS initiatives are in the early stages of planning and deployment in many jurisdictions. However, most jurisdictions are in various stages of implementation of ITS projects and there is significant interest in the jurisdictions to share information with their neighbors.

Beginning in Section 3, CSC/PBF developed a map of the MWCOG region and plotted the publicly owned and leased fiber assets. This map became the centerpiece of the final report as a tool to identify and communicate recommendations. The final report describes the state of ITS in the MWCOG jurisdictions, the interests of the MWCOG jurisdictions in the sharing of information, the inventory and analysis of telecommunications assets of the MWCOG member jurisdictions, and both short-term and longer-term recommendations to MWCOG for follow up activities. The map provides the reader with a visual aid for evaluating recommendations and to use for future planning purposes. The map is included in this report in a pocket.

After reviewing the inventory of telecommunications assets of MWCOG member jurisdictions, a number of conclusions were reached. Most notably, the chief fiber assets that exist in the region are owned by VDOT, MD SHA, and WMATA. Section 3 provides the detail of the inventory and conclusions.

Section 4 contains the results of the analysis of the telecommunications assets and sharing interests of the MWCOG member jurisdictions. The analysis documents specific interconnection of fiber assets that could facilitate data sharing activities. The nature of these recommendations include:

♦ Future opportunities to support a long-term vision of ITS data sharing in the region (Section 4.1);

♦ Immediate opportunities for interconnection of fiber assets (Section 4.2) that will yield short-term results;

♦ Details of a proposed regional backbone network between VDOT, MD SHA, and WMATA for sharing ITS data among jurisdictions; and

Finally, the report concludes with next steps for implementing the proposed regional backbone network. This connection would be the backbone system to support the interests of the MWCOG jurisdictions in sharing ITS data. The regional backbone network has the potential to provide a complete "picture" of traffic related information in the region including camera images, roadway/weather conditions, traffic signal status, and snow removal information.

1 Introduction

1.1 Background

State and some local governments in the Metropolitan Washington Area (MWA) are implementing advanced traffic management systems (ATMS) or other components of Intelligent Transportation Systems (ITS) to provide better traffic and transit information to the travelling public and technology for the management of incidents and congestion. Given increased public attention on traffic congestion and management, the cooperation of jurisdictions to share ITS assets is viewed as critical to enhancing services to the public.

In August 1998, a meeting of the *Regional Fiber Optic Task Force*, a subcommittee of the Intelligent Transportation System Task Force, was conducted under the umbrella of the Metropolitan Washington Council of Governments (MWCOG). A presentation was made during this meeting of a map that diagramed the presence of fiber optic cabling systems in the MWA. In this meeting and subsequent meetings, multiple jurisdictions expressed interest in the possibility of utilizing these assets for the sharing of ITS data among jurisdictions and developing a regional telecommunications architecture for ITS. One of the driving forces of this initiative was a Washington Metropolitan Area Transit Authority (WMATA) offer to consider using available excess fiber optic cable capacity along Metro tracks for ITS-related purposes.

As a result of this meeting, the Maryland State Highway Administration (MD SHA) developed and submitted a scope of work to the Federal Highway Administration (FHWA) in the fall of 1998 to the further this initiative. This effort resulted in an appropriation of funds to MD SHA in June of 1999. Using the Network Management Services (NMS) contract available to all Maryland government agencies, MD SHA secured the services of Computer Sciences Corporation (CSC) and their partner PB Farradyne (PBF) to conduct the study. Known as the Washington Area Telecommunications Study, an agreement with CSC was signed in August 1999 to execute the project.

1.2 Scope

The original scope of the study was to identify and analyze information exchange needs between jurisdictions and to recommend a telecommunications infrastructure to support those needs on a multi-jurisdictional basis. Because a significant amount of time had passed since the *Regional Fiber Optic Task Force* met in August 1998, several changes occurred. The *Regional Fiber Optic Task Force* was no longer in operation and several of the key personnel in MWA jurisdictions changed. During the project kick-off meeting on September 9, 1999, the scope of the project was amended to include the following:

♦ A detailed inventory of existing telecommunications assets and utilization data if it exists is to be developed in a Geographic Information Systems (GIS) format to document existing telecommunications assets within each jurisdiction. An understanding of the existing systems located on either end of these telecommunications assets is to be developed. The Virginia Department of Transportation's (VDOT's) Smart Travel Center in Arlington and MD SHA's Statewide Operations Center are to be included.

♦ An inventory analysis is to be conducted to ascertain the potential for connecting the regions disparate telecommunications infrastructures. This is to be a high-level opportunities analysis. Information exchange needs between jurisdictions are not to be specifically identified; rather recommendations and findings are to be structured as a "set of opportunities" for interconnecting networks to form larger networks, information exchange opportunities, video sharing, etc. The format of the findings is to be useful for MWCOG jurisdictions to put forth potential projects for funding and implementation.

♦ The stakeholders are to include the member agencies of MWCOG as well as the National Park Service and the Metropolitan Washington Airport Authority. Extended geographic areas of the study should include I-66 west to I-81 and I-95 south to Fredericksburg to the extent possible.

The final report is to summarize the telecommunications inventory, analyze the inventory, and recommend quick deployment opportunities for further investigation and analysis. A draft report is to be reviewed by the stakeholders of the ITS Task Force.

1.3 Methodology

Traditionally, information technology related engineering studies follow a structured process of defining requirements, analyzing existing systems, and developing a set of specifications to satisfy the requirements. However, as mentioned above, several jurisdictions have implemented or are in the process of implementing ITS technologies and in doing so they must operate within the resources and constraints of their jurisdictions. For that reason, it was determined that the scope of the study should focus on defining existing telecommunications assets being used for ITS purposes. From this study, CSC/PBF and the MWCOG jurisdictions would be able to identify immediate and long-term opportunities for sharing ITS information. In addition, after completing the study, CSC/PBF would be in a position to make recommendations for future projects. This approach was presented to and approved by the entire ITS Task Force on September 24, 1999.

To produce a meaningful report, CSC/PBF determined that the interview process would need to focus on three areas: (1) what ITS activities were being implemented by the member jurisdiction, (2) what immediate needs did the jurisdiction have for ITS data, and (3) what telecommunications assets were currently in use and planned for ITS purposes.

CSC/PBF contacted the MWCOG jurisdictions and other organizations recommended by the ITS Task Force to be included in the study. Interviews with each jurisdiction attempted to include someone from public works/transportation, transit, and information technology. CSC/PBF conducted the interviews, documented the interviews, and sent the summary to the jurisdiction for review and comment. Exhibit 1-1 lists the organizations that were contacted to participate in the study.

Jurisdiction	Response	Interviewed
Arlington County	+	√
City of Alexandria	+	√
City of Fairfax	+	√
City of Falls Church[1]		
District of Columbia	+	√
Fairfax County	+	√
Frederick County	+	√
Loudoun County	+	√
MDOT, MD SHA	+	√
Montgomery County	+	√
Prince George's County	+	√
Prince William County	+	Via phone
PRTC	+	√
VDOT	+	√
Regional Bodies		
MWCOG	+	√
National Park Service[2]		
MWAA	+	√
WMATA	+	√

Exhibit 1-1. Organizations Contacted to Participate in the Study

During the interview process, it was determined that none of the MWCOG agencies maintained GIS coordinates for telecommunications assets. Therefore, CSC/PBF in consultation with MD SHA determined that it would be better to map the fiber optic assets in the region. From the map and the interviews, CSC/PBF would be able to identify immediate opportunities for jurisdictions to exchange information and to make recommendations for future projects.

With the interviews complete, CSC/PBF has developed the regional map and produced this report. The team believes these tools will be valuable to the MWCOG jurisdictions for planning and implementing ITS systems in the region and the pursuit of data sharing opportunities.

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[1] City of Falls Church was contacted and did not express an interest in participating in the project.
[2] Through initial conversations it was mutually determined that the National Park Service did not have sufficient telecommunications assets to warrant an interview.

1.4 Organization

The report is divided into four (4) sections: Introduction, ITS and Interest in the Sharing of ITS Data, Telecommunications Inventory by Jurisdiction, and Recommendations.

Section 1 provides background and other information necessary to understand the focus and the formulation of the project. This is critical to understanding the approach to the project.

Section 2 describes the state of development of ITS systems in use by the jurisdictions. This is not intended to provide detailed information by system but to give the reader a high-level understanding of the maturity of ITS in the region. Section 2 also focuses at a high level on describing the data sharing needs and interests of MWCOG jurisdictions. The reader is cautioned that this does not represent all interests of the individual jurisdictions but again gives the reader a view to put findings and recommendations into context.

Section 3 provides detail regarding the inventory of telecommunications assets in the MWCOG jurisdictions. Crucial to this section is the accompanying map that provides information on fiber optic assets that are publicly funded. It is recognized that other privately owned fiber assets exist in the MWA.

Section 4 is the result of the analysis of the interviews and research. The findings and recommendations are intended to provide a basis for cooperation among jurisdictions to develop projects that will share ITS information. It is anticipated that this section will stimulate short-term projects and will be a useful tool for developing a long-term vision for the entire region.

2 ITS and Interest in the Sharing of ITS Data

As noted in the Introduction to this study, before one can identify telecommunications opportunities for the sharing of ITS data, three things must be known:

♦ What ITS is in place that generates data?

♦ What ITS data is of general interest to neighboring jurisdictions?

♦ What telecommunications assets are available to support the sharing of that data, and where are these assets located?

With that information, it is then possible to identify telecommunications opportunities for the sharing of ITS data. This process is shown in Exhibit 2-1.
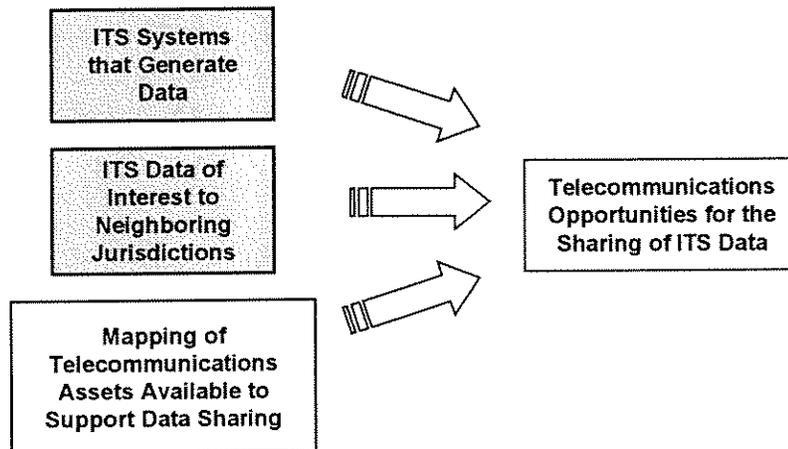
Exhibit 2-1. Process for the Identification of Telecommunications Opportunities to Support ITS Data Sharing

In this section of our study, only the first two areas cited above are discussed: ITS systems that generate data and ITS data of general interest to neighboring jurisdictions. The discussion is based on interviews that were conducted with Departments of Transportation and Departments of Public Works throughout the MWA and with regional transportation bodies.

2.1 State of Regional ITS Development

There is wide disparity in the types and scope of ITS systems being deployed in neighboring jurisdictions within the MWA. Some ITS systems are quite sophisticated with extensive data of potential interest being collected, while in other jurisdictions ITS exists only in its most rudimentary form, if at all. As one would expect, state governments generally have the most extensive systems while many county and city governments are just getting into ITS.

Interviews were conducted with a number of jurisdictions to determine exactly what ITS exists in those jurisdictions and what ITS data is of general interest should it be feasible to share that data across jurisdictions. However, before presenting those results, it is important to be able to group the information in some meaningful way.

For the purpose of this study, we have chosen to identify ITS needs within the framework of the Intelligent Transportation Infrastructure (ITI)[3]. ITI refers to those portions of ITS-related hardware, software, services, etc., that manage and support transportation-related activities, primarily but not exclusively in metropolitan areas. The US Department of Transportation (US DOT) chooses to break ITI into the following components.

- ◆ **Regional Multimodal Traveler Information System**
- ◆ **Traffic Signal Control System**
- ◆ Freeway Management System
- ◆ **Transit Management System**
- ◆ **Incident Management Program**
- ◆ Electronic Fare Payment System
- ◆ Electronic Toll Collection System
- ◆ Railroad Grade Crossing Warning System and
- ◆ **Emergency Management System**

Of these components, only the ones shown above in bold type are discussed in this report because these are the components most frequently mentioned during the interview process and the components in which the most interest was expressed. Hence, these are the components for which the sharing of data is of immediate interest.

These components of interest are further defined[4] as follows:

- ◆ <u>Regional Multimodal Traveler Information Systems</u> provide real-time road and transit information to travelers, businesses, and commercial carriers using a variety of media. These systems receive roadway and transit system surveillance and detection data from a variety of sources provided by both public and private entities and have the capability to combine data from different sources, package the data into various formats, and provide the information to a variety of distribution channels.

- ◆ <u>Traffic Signal Control Systems</u> monitor street traffic volumes and automatically adjust signal timing to optimize traffic flow. Traffic signal control may incorporate peripheral elements not essential to the task of traffic control per se, which may enhance overall traffic management capabilities. Such elements may include closed circuit TV surveillance; motorist information and/or traveler information components; a database management system to support analysis and development of management strategies; and data exchange with other traffic management systems.

- ◆ <u>Transit Management Systems</u> monitor and maintain transit fleets through advanced technologies that can track vehicles. Transit vehicles equipped with Automatic Vehicle Location (AVL) technology provide the basis for vehicle tracking. The use of AVL also

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[3] *National Intelligent Transportation Infrastructure Initiative*, September 19, 1997, Intelligent Transportation Systems Joint Program Office, US Department of Transportation.
[4] Intelligent Transportation Infrastructure Definitions, http://itsdeployment.ed.ornl.gov/iti98/definitions.htm.

supports advanced demand-responsive computer-aided routing and scheduling to provide optimal vehicle assignment and routing.

♦ Incident Management Programs allow jurisdictions to spot and respond to crashes or breakdowns quickly. Incident Management fully maintains communications with Emergency Management Services to respond to incidents, manage incident sites, and restore traffic flow conditions. Incident Management may also be integrated with Traffic Signal Control to affect coordination between traffic signal times to accommodate traffic diversion during incident response.

♦ Emergency Management Systems link incident management centers to alert the closest available emergency response unit. Through the use of AVL equipment, emergency service dispatchers can make optimal assignment of vehicles to incidents. Emergency management provides information to Incident Management concerning the severity, location, and type of incidents.

These systems are addressed in this report.

2.2 Neighboring Jurisdictions and Their Interest in the Sharing of ITS Data

The following paragraphs describe ITS in use in each of the jurisdictions with which interviews were conducted and their general interest in the sharing of ITS data. A more complete description for each jurisdiction is provided in the Interview Reports included in this report as Appendix A.

2.2.1 Arlington County

Two signaling systems are deployed in Arlington County, and the corresponding signal control computers and workstations for each system are located in the Department of Public Works (DPW) computer room at Clarendon Boulevard. Other than the real-time data collected and processed by one of the systems (SCOOT), no other traffic data is being collected using the signal systems.

Arlington DPW has a cooperative relationship with VDOT concerning signal coordination with VDOT-controlled signals near the county boundaries. VDOT has permitted the county to assume control of some of its signals at nearby key intersections on roadways leading into Arlington. There currently are no efforts regarding signal coordination at the Arlington/Alexandria border.

The SCOOT system was installed in anticipation of implementing adaptive timing routines and signal priority/preemption capabilities. Arlington County will be a participant in the ITS prototype study for regional signal preemption for emergency and fire service vehicles (police vehicles are currently excluded) and signal priority for buses.

The county has a single traffic surveillance camera. The viewing monitor and the camera control console are located in the DPW computer room. There has been coordination between VDOT and DPW concerning placement of VDOT's cameras within the county. The county is interested in receiving video from VDOT cameras, and the Arlington County Police Department has expressed interest in having video available in its Emergency Communications Center (ECC).

The county has no plans to install any additional ITS devices, principally because there are VDOT controlled ITS devices along the highways passing through the county. County vehicles are not equipped with AVL or Global Positioning System (GPS).

Public transit in Arlington is principally provided by WMATA's MetroBus and MetrolRail systems. Arlington has a very close working relationship with Metro concerning the routes and schedules in the county and has cooperated with Metro by assuming responsibility for most of the bus stops in the county. Additionally, the county operates two feeder loop bus routes serving the MetroRail stations at Crystal City and Rosslyn. Arlington officials are firm believers in signal priority for buses and DPW will be evaluating all of the bus stops in the county.

The county is also very interested in real-time traveler information displays at bus stops. In the near term, Arlington County would like to deploy displays showing static schedule information. The incorporation of real-time schedule status would be dependent on the implementation of AVL on the MetroBus fleet (not expected for several years).

2.2.2 City of Alexandria

Alexandria has a Transportation Operations Center (TOC) located at City Hall on the ground floor.

The existing signal system is being replaced with one having expanded capabilities for traffic counting plus control and communications to variable lane control devices, weather monitoring stations, and dynamic messaging signs. There are approximately 220 signals in the city, 160 of which are on the signal system. Traffic counts on boundary roads are conducted annually using temporarily deployed rubber tube counters. There has been no effort to date for coordination with signals in neighboring jurisdictions.

The city has a single traffic surveillance camera. The viewing monitor and the camera control console are located in the TOC. Additional cameras are going to be acquired. The city is experimenting with video detection for signaled intersections. Alexandria is interested in receiving video from VDOT cameras but would also like to see continued future deployment of city-owned cameras. The Alexandria Police administer a photo red-light system within the city. One camera is rotated between three intersections equipped for the system.

City maintenance vehicles are not equipped with AVL or GPS. Snow removal operations are coordinated from the maintenance shop.

Alexandria is interested in improving its traffic counting capabilities as an aid to implementing adaptive traffic management strategies and improving incident management strategies. The city has started collecting some dynamic traffic volume data and recently installed a side-fire microwave radar, principally for use as a traffic counter. City personnel are also looking into the use of cameras for counting. Alexandria is interested in improved traffic data sharing with neighboring jurisdictions.

In addition to MetroBus, bus services within the city are provided by DASH. DASH is a private entity owned by Alexandria. DASH vehicles currently are not equipped with AVL or GPS.

2.2.3 City of Fairfax

The current signal system was installed in stages, beginning in the mid-1980s and completed in the early 1990s. The signal system can collect traffic volumes but currently is not set up to do so. City staff routinely uses a portable laptop computer to communicate with the system. The city is waiting on the approval of funding from the Transportation Coordinating Council (TCC) to deploy up to seven Closed Circuit Television (CCTV) cameras. The City of Fairfax was the first jurisdiction in Virginia to deploy Photo Red-light cameras.

The city has no existing or planned Highway Advisory Radio (HAR) or Variable Message Signs (VMS). No Roadway Weather Information System (RWIS) or AVL systems exist. The city is currently preparing a grant to secure funding for an AVL system, but it likely to be 3-5 years before deployment. There is interest in using pavement temperature sensors that could be supported by the existing signal system.

The City University Energy (CUE) Saver transit system runs seven days a week along two routes with average frequency ranging from 15-30 minutes. Both routes service the George Mason University campus and the Vienna/Fairfax-GMU Metrorail station along I-66. The city also operates a paratransit system. The city provides its own in-town service called City Wheels and is a participant in the Metro Access program (regional paratransit program).

Fairfax City officials are particularly interested in information that would facilitate relaying real-time bus schedule status information to bus shelters. They are also studying coordinated Smart Fare technology with connecting transit services (principally MetroBus, MetroRail, and Fairfax Connector).

2.2.4 District of Columbia

The only ITS system in use by DC today is their signal system, although new video and data systems to assist with incident, freeway, and bridge management are planned. It is the intent of DC officials to establish a state-of-the-art Traffic Management Center for the city within the next five years.

Approximately 1,500 signals are controlled throughout the city and visually displayed on computer screens in the Traffic Management Center located on the 2nd floor of Department of Public Works building located at 2000 14th Street. In addition to visually showing the status of all signals, the system is capable of providing information on traffic volumes. The system also provides for signal preemption (at 21 locations), which is employed by DC fire fighters and other emergency response personnel.

Looking towards the future, there is an on-going project to develop a fully integrated ITS system for DC. This work is to be done in accordance with the National ITS Architecture. Federal Highway Administration funds have already been identified and allocated for this purpose. The initial work will emphasize incident, bridge, and freeway management.

No signal data is currently shared with others jurisdictions with the exception of a pilot project with Montgomery County for the synchronization of signals along Wisconsin Avenue at the DC line. Not withstanding this fact, DC Officials recognize the need to share signal, incident, freeway, and bridge data/video with a number of organizations and jurisdictions including the

Park Police, DC Police, Transit authorities, Montgomery County, Prince George's County, and Virginia.

2.2.5 Fairfax County

VDOT is responsible for the traffic signal system in Fairfax County. The signal control system is based on the Management Information System for Transportation (MIST) technology. The signal system is currently running time-of-day signaling routines. Efforts are underway to activate the counting capabilities of the signal detectors at each intersection. Some intermediate detectors, called system detectors, have also been installed to sense traffic thresholds between intersections. Video detection is also being examined for its long-term maintenance cost savings over traditional loop detectors in the pavement.

Fairfax DOT has a cooperative relationship with VDOT concerning the management and timing of the signals. In fact, the installation of a MIST terminal in Fairfax DOT's offices in the County government center is in progress. This terminal will enable Fairfax DOT to observe the timing cycles and access other data collected by the system such as traffic counts. Fairfax DOT would like to see MIST's capabilities to run incident management routines and adaptive timing routines be implemented. Fairfax DOT is also a participant in the ITS prototype study for a regional signal preemption system for emergency and police vehicles.

Photo red-light is being deployed. The current plan is to have 10 cameras rotated around the county. A full array of ITS devices (cameras, advisory radios, messaging signs, etc.) has been deployed by VDOT. There are no plans to install additional county-owned devices. The county's maintenance fleet is not AVL-equipped, but the county would like to do so.

Fairfax DOT operates the Fairfax Connector fixed-route bus system. Fairfax County Community and Recreation Services operates the FASTRAN para-transit system. FASTRAN operates a small number of fixed routes in addition to individual call services. Neither service fleet is AVL-equipped. Fairfax DOT is interested in the eventual implementation of AVL-based real-time schedule and status information system for both systems. An interest in participating with a seamless smart fare system covering regional transit systems was expressed.

Other interests include providing more information to the public regarding parking garage availability, bus schedules, and other information that will promote use of transit systems.

2.2.6 Frederick County

Frederick County population grew by 28% from 1990 to 1999. As a result, most resources went to the building of new schools. However, with the concurrent increase in traffic and accidents during this same period, traffic management has assumed ever-greater importance.

Because of its rural nature, there are only two signals (at the intersection of county roads) controlled by the DPW with the majority of signals within the county being controlled by the MD SHA. Further, signals within city or town boundaries are controlled by individual jurisdictions, not by the county.

Planning for the future is performed jointly with state officials when appropriate, and some limited use is made of MWCOG regional transportation models.

Public transit services are provided within the county by TransIT. These services include fixed routes within Frederick City, county shuttle, MARC shuttle, paratransit, and commuter assistance services. Limited interface takes place with Montgomery County because some Montgomery County Park and Ride routes extend to points just inside Frederick County.

Frederick County officials suggest that there is an immediate interest in weather conditions, long term traffic analyses, and incident management, particularly along I-270.

2.2.7 Loudoun County

VDOT manages all signals in Loudoun County and is working to provide a terminal to the county for monitoring purposes. Signal preemption for fire and rescue purposes is planned on a trial basis at Routes 7 and 641. Loudoun County has an interest in receiving information related to incidents on Interstates 495, 66, and 95.

2.2.8 Maryland State Highway Administration (MD SHA)

The principal vehicle MD SHA has used for the deployment of ITS systems is the Coordinated Highways Action Response Team (CHART) program. CHART has evolved into a program for the deployment of video cameras, Dynamic Message Signs (DMS), Traffic Advisory Radio (TAR), RWIS, and speed/lane occupancy detectors statewide. The majority of the devices and all the cameras are concentrated in the densely developed Baltimore-Washington corridor. CHART's significance extends beyond its immediate uses. CHART is likely to constitute a significant portion of Net.Work.Maryland, an initiative for the design and deployment of a statewide, high-speed fiber network.

The CHART system is enhanced by a state-of-the-art command and control center called the Statewide Operations Center (SOC). The SOC acts as the hub of the CHART system, functioning 24 hours a day, 7 days a week. There are additional satellite Traffic Operations Centers (TOCs) spread across the state to handle peak-period traffic.

There are currently 38 operational cameras, with approximately 10 more scheduled to come on-line shortly. Over 200 cameras will be deployed when the CHART build-out is finished. A unique feature of CHART is that viewing and control of cameras is not limited to the SOC. CHART uses asynchronous transfer mode (ATM) technology for the control and distribution of video images at multiple MD SHA facilities.

DMS, TAR, RWIS, and speed/lane occupancy detectors have been and continue to be installed statewide. Communications to these devices are centralized on the SOC. The SOC subscribes to the SCAN weather service to supplement data from the RWIS to monitor weather conditions across the state.

Traffic counting is currently performed at 90 sites statewide.

CHART hosts a web site for dissemination of traveler information to the public. A visitor to the site can view live video from the cameras, observe a roadway conditions map, obtain weather reports from SCAN, and view the most recently reported data from the RWIS.

While the initial CHART system was centralized on the SOC, a new initiative—CHART II— will support access to field devices from multiple MD SHA facilities.

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Of the some 4600 signals in the state, approximately 2000 are MD SHA's responsibility. The deployment strategy to date has been to "put the smarts on the road" and let the signal controllers do their work. The controllers have call-back capabilities when certain threshold conditions occur.

The current signals use in-pavement sensors for vehicle detection. New technology that uses cameras for vehicle detection is being explored. Discussions also have started about the possible integration of the signal control system into CHART.

The maintenance and snow removal fleets currently are not equipped with AVL, but AVL is of interest.

MD SHA is a strong proponent of sharing ITS video and data with neighboring jurisdictions, other state and MDOT agencies, and the public. While that data sharing is already extensive, the following additional needs were identified:

♦ The ability to see the whole Capital Beltway and other major highways leading into and out of the state. MD SHA would like to know what is on the other side at the transition points.

♦ Improved I-95 Coalition coordination.

♦ The sharing of information between the SOC and VDOT's Smart Travel Center.

♦ Evolution of the SOC into a multimodal operations center and information clearinghouse for all Maryland Department of Transportation (MDOT) modals.

♦ A common protocol for the exchange of information both within and without CHART.

State of Maryland transit operations were not discussed in the meeting with MD SHA representatives.

2.2.9 Montgomery County

Montgomery County's ATMS is used to collect traffic information on all arterial roadways in the county, verify and monitor incidents to coordinate response activities, and make the roadway condition information collected available to the public. It is an arterial management system whose operations are coordinated with the MD SHA CHART program.

The ATMS handles the county's signals, other ITS collection devices (loops, CCTV, etc.), geographic information systems, and the county's transit system as an integrated whole. Central system capabilities are currently being enhanced to implement more robust GIS capabilities and a database that is based upon ITS industry standards to promote the sharing of data. Specifically, the system includes:

♦ A traffic signal system of some 750 signals. The system is capable of providing real-time traffic operations and collecting traffic count data.

♦ Eighty-five CCTV cameras for verifying incidents and traffic operations. Two hundred are planned. CCTV camera images are shown on the county's cable system and are supplemented with real-time TAR audio.

♦ Travel advisory radio at 12 sites.

- GPS transponders installed in 100 of some 250 busses. The eventual goal is to link this information with signal synchronization within the framework of the overall ATMS.

- A Transportation Management Center linked to the State's operations center and capable of sharing video with that center as well as with local news stations.

- A website that provides comprehensive traveler information including access to CCTV camera images and accident and lane closure information. The County also shares traveler information with the Partners In Motion, Metro Traffic and the local media

Looking to the future, Montgomery officials foresee:

- The linking of all local ITS management centers to facilitate the goals and objectives of the Regional Operations Coordinating Committee (ROCC), snow removal, etc.

- Synchronized signal prioritization at and across borders with other jurisdictions (e.g., City of Rockville, Prince George's County, District of Columbia)

- Linking with VDOT for CCTV and incident information

- Sharing CCTV camera images with Prince George's county

- Coordination of transit information and dispatch capability with WMATA to coordinate local and regional transit operations

- Providing bus priority treatment at signalized intersections

- Potential co-location with the County's emergency management services

- Traffic responsive signal operations

- Parking management systems

2.2.10 Prince George's County

Current PG County ITS activities are a natural outgrowth of the county systems used to control and operate some signals located at 139 major intersections throughout the county. The signal system is currently being upgraded to provide a better control and reporting capability. Using the new system, pavement temperature data and traffic counts will also be collected and included in a GIS database.

The county is in the process of constructing a Traffic Response and Information Partnership (TRIP) center. Once complete, the updated signal systems will be integrated into this center. At present, no CCTV cameras are owned or operated by the county although two are planned. Consideration is also being given to using video detection systems to replace loop detectors throughout the county and for incident management.

Five portable VMS are currently in use, and three additional signs are being purchased, as are two semi-stationary signs.

Transit operations include bus and paratransit services within the county.

County officials are interested in systems to provide incident and transit information to county residents on a county website and on county cable; video feeds from Maryland's CHART, VDOT, and Montgomery County systems used for incident management; traffic condition information along Maryland and Interstate routes that would affect the county in the event of a

Washington Beltway closure; and AVL systems in county snow removal vehicles and on a new GIS-based system in the TRIP center.

2.2.11 Prince William County

No information was obtained on any existing ITS systems in Prince William County.

2.2.12 Potomac and Rappahannock Transportation Commission (PRTC)

PRTC operates local bus service throughout Prince William County and commuter bus service to the Arlington and Washington areas. Local buses are outfitted with AVL and GPS, and a test of real-time route deviation along local bus routes is in progress. When fully operational, bus drivers will confirm trip completions via a Mobile Data Terminal (MDT) by transmitting to the central tracking system.

Significant service disruptions and schedule changes are provided to the Partners-In-Motion on a regular basis via list-serve e-mail. Future ITS plans are not fully defined, although PRTC has a keen interest in providing information to its customers, perhaps via a Travelers Advisory Telephone system.

PRTC does not participate in any regional or local bus signal priority systems but would be interested in participating along the Arlington/Washington corridors. PRTC is also interested in regional teleconferencing and the establishment of a common communications network for transit providers.

2.2.13 Virginia Department of Transportation (VDOT)

The interview with VDOT focused on telecommunications assets, but some information was obtained on ITS in Northern Virginia (NOVA).

VDOT has a Smart Travel Center (STC) connected to a number of video cameras located on principal interstates throughout NOVA. There are large numbers of ITS devices for monitoring traffic, weather conditions, ramp metering, etc., and most of these units are monitored at the STC. It is intended that video and other ITS information available within the STC be shared with Maryland's new CHART system and with Partners In Motion. Video images will also be shared with emergency service providers (Fairfax County Police, State Police, etc.).

There are some 1,000 signals in NOVA managed from a central location within VDOT facilities. While connectivity is planned from the STC to this location, there is no intent to integrate signal management with the overall management of ITS from the STC. Having said that, the STC will share incident management information with signal operations, and signal operations will share data with transit operating agencies to implement signal prioritization. Signal operations will also coordinate signal timing with neighboring jurisdictions.

More detailed needs for data sharing were not identified at the meeting as VDOT participants felt the information would best be provided as part of a Northern Virginia ITS Architecture planning document now in preparation.

2.3 Organizations with Regional Responsibilities

In addition to the individual jurisdictions described above, there are several other organizations that have a more regional interest in ITS and the sharing of ITS data. The interests of each of these organizations are described in turn.

2.3.1 Metropolitan Washington Council of Governments (MWCOG)

While MWCOG has responsibility for regional transportation planning, it does not have direct control of any ITS assets. Rather, it is the beneficiary of information collected through the use of member ITS assets. The information thus collected is maintained in several GIS databases and made available to all local jurisdictions. MWCOG also maintains several regional transportation planning models that are shared with these same jurisdictions.

MWCOG maintains a Regional Transportation Data Clearinghouse that includes traffic volumes and other data for highway links in the modeled regional transportation network. All ITS data used for planning purposes is of interest to MWCOG, although MWCOG does not presently have the resources to "pre-process" the raw data. MWCOG is currently initiating a study to determine exactly which ITS data is most useful to local jurisdictions and hence most suitable for sharing. Present thinking is that the sharing of video images of traffic conditions should be given priority.

MWCOG recently began efforts to develop a regional wireless network for public safety purposes. The focus of the Capital Wireless Integrated Network (CapWIN) Demonstration Project is to integrate transportation and public safety data and voice communication systems in Maryland, Virginia, and the District of Columbia. The project is anticipated to have national implications in technology transfer including image/video transmission and the inclusion of transportation and public safety applications in an integrated system.

2.3.2 Metropolitan Washington Airport Authority (MWAA)

MWAA has a CCTV system that monitors traffic and security conditions at the arrival and entrance platforms, access roads, and remote parking lots throughout both airports (National and Dulles). Both analog and digital video is utilized; however, MWAA is migrating towards the use of digital video. The video is not distributed to the Internet or local and regional public transportation agencies. Airport police will respond to an incident if one has been detected and verified.

Optical Character Recognition (OCR) technology is being tested at Reagan National Airport in the daily A1 surface parking lot. OCR is anticipated to be deployed throughout the other surface lots and garages A-C by December 2000. The use of Smart Card technology for parking fee payment is being tested at Dulles airport. Smart Cart technology that is compatible with the OCR parking fee system, Dulles Toll Road, and WMATA Smart Cards is also under review. There is no deployment timetable, although the Smart Card technology will be implemented at Dulles International Airport. OCR and Smart Card technology are to be implemented together at both airports in the future. OCR will provide the motorist with an electronic payment ticket, and the Smart Card technology will provide the motorist with the payment mechanism.

In summer 2000, MWAA will be advertising a contract to revamp its flight arrival and flight departure information. The amount of information currently displayed at one time will be enhanced and expanded.

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MWAA owns the Dulles Toll Road. A roadway weather information system is in place along the toll road. MWAA future plans for the potential use of CCTV cameras along the Dulles Toll Road are unknown at this time; however, MWAA would be interested in receiving VDOT CCTV camera images of the Dulles Toll Road, if deployed.

A highway advisory radio system operating at the 530 AM dial setting is at Reagan National Airport.

2.3.3 Washington Metropolitan Area Transit Authority (WMATA)

Currently, WMATA has 250 buses equipped with a GPS system. These buses have next-stop annunciation capability. No AVL devices or tracking is currently done for WMATA buses, and as such, no real-time bus transit schedule information is available. Static bus transit schedule information is available on WMATA's website. An extensive AVL deployment that outfits the entire WMATA bus fleet is anticipated once the deployment of a new digital trunked radio[1] system is completed.

WMATA is interested in sharing the following ITS information with other MWCOG agencies:

♦ A common, regional bus signal priority system

♦ Fare integration, i.e., new fare boxes that are capable of handling cash and smart card transactions

♦ A common regional communications system for the region's bus providers: WMATA, Montgomery County Ride-On, Prince George's County The Bus, Alexandria DASH, Fairfax County Connector, City of Fairfax CUE, and PRTC's OmniRide

♦ The ability to expand transit traveler information dissemination, e.g., Dulles Airport Cable Channel

♦ Roadway weather information system data for use in routing buses

For WMATA's rail services, a dynamic rail transit display system informs passengers of the next destination and time of arrival for the next train. Information is displayed on the platforms. Deployment is on-going, with full deployment anticipated by the end of 2000, although real-time information may not be immediately available.

2.4 Summary of Data Sharing Interest

In the preceding paragraphs, the data sharing interests of each of the jurisdictions interviewed for this report were described. In Exhibit 2-2, we summarize this data by ITI component.

Data Sharing Interest	Arlington County	City of Alexandria	City of Fairfax	DC	Fairfax County	Frederick County	Loudoun County	MD SHA	Montgomery	Prince George s	Prince William[5]	PRTC	VDOT	Regional Bodies	MWCOG	MWAA	WMATA	Total Interest
Regional Multimodal Traveler Information Systems																		
Traffic information	√	√	√	√	√			√	√	√			√		√	√	√	12
Transit information	√		√		√				√	√		√			√	√	√	9
Video	√		√	√				√	√				√		√	√		8
Traffic Signal Control Systems																		
Traffic analyses	√	√		√	√	√	√	√	√	√			√		√			11
Traffic counts	√	√	√	√	√	√	√	√	√	√			√		√			12
Signal coordination			√	√					√				√					4
Transit Management Systems																		
Signal prioritization	√		√		√				√			√	√				√	7
Teleconferencing													√					1
Common communications network								√					√				√	3
Incident Management Systems																		
Weather information		√	√		√	√		√	√	√			√		√	√	√	11
Incident notification	√	√	√	√	√	√	√	√	√	√			√		√	√	√	14
Video	√	√	√	√	√		√	√	√	√			√		√	√	√	13
Emergency Management Systems																		
Video	√				√	√							√			√	√	6
Signal prioritization/preemption	√		√	√	√		√						√					6

Exhibit 2-2. General Interest in Data Sharing by Jurisdiction

The specific types of information and/or system in which a general interest in sharing was expressed is included under each ITI component (shaded in gray). Please note that these subcategories are functional areas of interest suggested during the interviews; they are not official ITI system sub-components. The purpose was to gain an indication of general interest in data sharing, not the identification of specific data sharing requirements. The latter will be determined in a separate MWCOG data sharing study, the contract for which was recently awarded, and through on-going efforts of the MWCOG staff in the development of a Regional ITS Strategic Plan.

The last column indicates the total number of jurisdictions expressing interest in sharing data or system information in each of the sub-component areas. While this is hardly a definitive measure, it does give an indication of general interest in specific areas.

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[5] The telephone interview with Prince William County focused on telecommunications rather than ITS assets.

2.5 Conclusions

Based on the preceding sections and the more detailed interview reports contained in Appendix A, certain conclusions can be reached regarding the state of ITS in the region and general interest in the sharing of ITS data:

♦ ITS systems within the region vary considerably in terms of scope and sophistication with most jurisdictions only beginning to realize the full potential of ITS.

♦ Very limited sharing of ITS data takes place among neighboring jurisdictions, and to the extent that such sharing is done, it is accomplished primarily through regional organizations such as MWCOG. Most local jurisdictions are focused on their own immediate ITS needs to the exclusion of regional ITS issues.

♦ There are several, on-going ITS architectural studies by individual jurisdictions that will impact the regional telecommunications architecture required to support the sharing of ITS data. The results of these studies must be known before a regional telecommunications architecture for the sharing of ITS data can be finalized.

♦ There is growing interest in the sharing of ITS data to support traveler information systems, traffic signal control systems, transit management systems, and incident management systems but limited interest in the sharing of this information with emergency management systems. (It should be noted, however, that the expression of interest in the sharing of ITS information with emergency management systems might have been very different if interviews had been conducted with police and fire officials responsible for that function.)

♦ There is significant interest in the sharing of video to support traveler information and incident management systems across most jurisdictions.

♦ The ITI provides a suitable framework for the discussion of ITS data sharing issues.

3 Telecommunications Inventory by Jurisdiction

In this section, telecommunications assets available to support data sharing are mapped and described as illustrated in Exhibit 3-1.
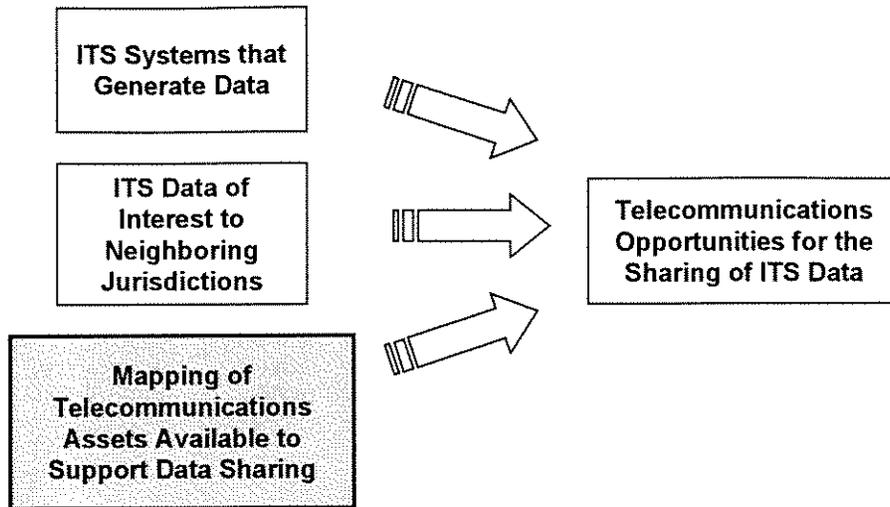
Exhibit 3-1. Process for the Identification of Telecommunications Opportunities to Support ITS Data Sharing

As was true for the previous section, this information is based on interviews that were conducted with Departments of Transportation and Departments of Public Works throughout the MWA and with regional transportation bodies.

3.1 Mapping of Telecommunications Assets

Included with this report is a map titled "Public Fiber Optics in the MWCOG Region" (see the inside back cover of the report). It will be beneficial to keep this map at hand for reference while reading this section. The map displays an MWCOG-wide view of the major telecommunications resources owned/controlled by the member jurisdictions. The goal is to provide a graphical illustration of existing assets and possible connection points between jurisdictions for the purpose of ITS data sharing.

The map was compiled from data obtained from the interviews held with each participating regional agency. Interviewees were asked to provide verbal descriptions of their major telecommunications resources and networks. Additionally, supporting materials in the form of maps and network diagrams were requested.

As the data was collected, it became apparent that fiber optic cables are the only significant form of high-capacity communications employed for long-haul networking, other than leased lines from the public providers. While some wireless resources, such as microwave and radio communications, are employed for data transmission, they are mostly used as feeder links to reach certain facilities and devices that are not conveniently located to existing fiber or copper cabling. The only significant use of wireless communications as a data transmission trunk is a link between the campus networks at Dulles International and Reagan National Airports implemented on MWAA's 800MHz radio system.

It was also learned that many MWCOG jurisdictions either already have or are in the process of obtaining fiber optic enterprise networks. These resources are typically leased or made available through resource sharing agreements from cable television and telecommunications providers. Because providers maintain most of these networks, detailed information about them was not immediately available. Consequently, the map concentrates on displaying the fiber optic trunk routes (both existing and planned) controlled by MDOT, VDOT, and WMATA. Significant facilities owned/operated by each jurisdiction and agency are shown on the map to indicate their relative accessibility to these fiber optic resources. A summary of each jurisdictional enterprise fiber network is also indicated. The map clearly shows the possible junction points between the trunks and points where jurisdictional networks may be connected.

3.2 Existing and Planned Telecommunications Assets

An overview of existing and planned fiber optic, wireless, and wireline resources employed by each agency/jurisdiction that participated in the interview process is provided in the following sections.

3.2.1 Arlington County

Currently, the Arlington County DPW has no fiber resources. Through a resource sharing agreement with Cox Cable, a fiber optic network is being deployed throughout the county. The Arlington County DPW will have access to and use of two fiber optic cables. A twisted-pair cable plant is used to operate the county's traffic signal systems. Beyond the resource sharing arrangement with Cox Cable and the existing twisted-pair cable plant, there are no significant wireline resources except POTS voice circuits. In addition, the traffic signal system controlled from the Arlington County DPW building has no network connectivity to any other regional transportation centers.

3.2.2 City of Alexandria

Jones Intercable (owned by COMCAST) provides fiber infrastructure to the city of Alexandria via a resource sharing agreement. This network is called the Institutional Network (INET). SONET OC-3 fiber drops are located at most city administrative facilities, schools, libraries, fire/police stations, and other public buildings including the City Hall where the traffic signal system is operated. While the cabling is complete, integration of sites onto the fiber is about 2/3 completed.

The City Hall traffic signal operations center communicates with the city Department of Public Works and Transportation's (DPWT) maintenance facility via the INET. Other than the maintenance shop link to VDOT for SCAN, the city's traffic signal operations center has no connectivity to other regional transportation agencies.

3.2.3 City of Fairfax

The City of Fairfax uses twisted-pair copper cable for the traffic signal system. The city's Signal Shop is located in the Property Yard at 3410 Pickett Road. An Emergency Command Center is also located adjacent to the Signal Shop within the compound. Beyond telephone service, no other communications medium connects buildings and facilities in the compound. Furthermore,

the city's Signal Shop is not connected to any regional transportation agencies. While the city has no fiber optic cable system of its own, six service providers including Bell Atlantic have fiber capacity that the city will consider leasing.

Telephone and radio systems comprise the city's wireless communications capabilities. A dedicated radio frequency is reserved for the CUE system and one is dedicated for vehicle-to-vehicle operations.

The city is currently preparing a Transportation Master Plan that should be completed in May 2000. A goal of the plan will be to support the use of advanced technology to operate the city's roadway and transit systems. Specific details were not available for inclusion in this report at the time of this writing.

3.2.4 District of Columbia

All signal wiring is currently copper. However, a consultant has been tasked with developing a fiber optic system to support signals and other ITS needs. This fiber will follow existing routes, using existing conduit. No use of other fiber (WMATA or otherwise) is anticipated.

Once DC has its fiber in place to support its new ITS system, it will then be in a position to cooperate in the sharing of data and video. DC Officials opined that DC's future fiber might be useful in providing connectivity between adjacent jurisdictions. The DC Traffic Management Center is located just two blocks from the WMATA U Street/Cardozo Metro Station.

3.2.5 Fairfax County

Through a resource sharing agreement with Cox Cable, Fairfax County is deploying an extensive fiber optic network called the Institutional Network (INET). The INET will connect 400 county offices, public facilities, and schools and is scheduled for completion in May 2002. It will feature an OC-48 backbone and will provide data, voice, and video services. Six strands of fiber will be made available at each site on the INET. Beyond the INET and traditional phone lines, there are no significant wireline resources employed for dedicated use by Fairfax DOT.

Fairfax DOT's maintenance fleet and the Fairfax County Connector transit fleet use channels assigned from the county's existing radio system.

3.2.6 Frederick County

IIT, an authority board for County Government, manages a leased fiber backbone network for Frederick County that includes 12 major hubs at locations in the city of Frederick, some DPW facilities, and the site of the planned Public Safety Building (a joint facility for the Sheriff's Department, State Police, and Central Alarm). The fiber between nodes provides an OC-3 to OC-12 capacity depending on the leg. The backbone currently handles voice, data, and video (for the detention facility) on separate fibers and systems. The backbone fiber is owned by GS Communications Inc., the county's cable television franchisee.

3.2.7 Loudoun County

No information was obtained on any existing wireline and wireless telecommunications.

3.2.8 Maryland State Highway Administration (MD SHA)

Through a resource share agreement with MCI, MD SHA/MDOT has 48-fiber optic strands that run down I-83 from the Pennsylvania border to I-695, around the west side of I-695, then down I-95 to I-495, where it terminates in a communications hub facility in College Park. This fiber is being utilized to build the CHART network backbone. Five MD SHA facilities are currently connected via this fiber: District 4 HQ, Radio Shop, SOC, TOC3, and District 3 HQ. Communications over this fiber are ATM over OC-3 SONET.

Significant additional fiber will become available in conjunction with the Net.Work.Maryland effort. Resource share fibers will be obtained from Level 3 Communications along I-68 from the west to I-70, down I-270, then along I-495 to a communications hub in McLean, Virginia. Another leg will leave this hub, go through the District of Columbia, and enter Maryland along the US-50 corridor to I-97. From here it will head up I-97 to I-695, to I-95, and will extend to the Delaware border along I-95. A third leg will come up US-301 from the Nice Bridge in southern Maryland, connecting with the leg along US-50 west of Annapolis. Communications over this fiber are expected to be ATM over OC-192 SONET. In the long term, the CHART backbone will be integrated into Net.Work.Maryland. 12 strands of this fiber will be reserved for ITS and SHA networking.

MD SHA uses many different wireline services to communicate with facilities and devices across the state. T-1 lines for camera sites and CHART backbone connectivity have already been mentioned. MD SHA's enterprise backbone makes extensive use of frame relay with ISDN backup, particularly outside the densely developed center of the state. There are numerous POTS lines to the DMS, TAR, detector, and RWIS devices. ISDN is being phased in for the DMSs as part of CHART II. Leased ATM services may also be employed to reach future hub sites on the CHART backbone.

MD SHA maintains a statewide radio system. The Radio Shop, located at the west-side intersection of I-695 and US-40, is the main maintenance and laboratory/test bed facility. Communications to the maintenance fleet is via the radio system. Maintenance vehicles are not equipped with AVL.

3.2.9 Montgomery County

The County has re-engineered their copper plant to make it compatible with a new fiber optic cable plant – FiberNet. While additional detail will be required, FiberNet was generally described as an OC-3, 155 mbps network utilizing a meshed trunk backbone that will support multiple networks. There will be eleven hub sites connected via the meshed main trunk. Extending out from the hubs are feeders. From these feeders, individual connections (called drops) reach out to each entity on the network. Connectivity on the meshed trunk is via a 24-strand multi-fiber cable. The feeder lines will consist of up to 144 fibers. The network consists primarily of aerial segments with underground segments installed where necessary. ATMS services have been the predominant use to date and will continue to be the primary user of the network for some time.

FiberNet will also provide connectivity with the MD SHA as Montgomery County will become a Traffic Operations Center (TOC) on the MD SHA, CHART fiber optic network. Just as information collected by the SOC will be made available to Montgomery County, similarly

information collected at the Montgomery County Operations Center will be made available to the state. Initial planning was for the state and Montgomery County networks to connect at the Beltway, but current planning is for the networks to connect near the Montgomery County signal shop located near I-270 and Seven Locks Road.

Spread Spectrum Radio (SSR) is being experimented with for transit signs at bus stops (for short hops where fiber would be too expensive). Microwave is utilized as the link between the county aircraft and permanent and mobile ground sites up to 10 miles distance. A mobile GIS system using a conventional two-way radio system is being tested for command and control access to the transit database. No cellular service is used for ITS purposes.

Video will be made available at some maintenance sites and at the County Emergency Operations Center, which is located across the street from the Transportation Management Center (TMC). Future plans also call for it to be made available to mobile police and fire command centers.

3.2.10 Prince George's County

Comcast Cable, Inc. is currently installing cable throughout Prince George's County and, as part of its agreement with the county, will provide some fiber to all major county buildings. Today, dialup modems are used to provide connectivity from all signals to the closed-loop signal control system. CCTV cameras scheduled for installation will probably be operated over twisted pairs, but a higher capacity service may be necessary depending on the quality of the video desired.

Radio systems are used for communications with DPW&T vehicles. The radio system has two bands, one for DPW&T and the other for the county's transit systems.

3.2.11 Prince William County

Prince William County leases fibers from GTE to provide connectivity between major office sites and public facilities. The major county government complex is located at One County Complex Court in Woodbridge, Virginia, just off the Prince William Parkway. Currently, the network uses Multimedia Data Service (MMDS) to carry 10MB Ethernet LAN and voice traffic. In year 2000, the network protocol will be transitioned to ATM. GTE will service its high capacity trunks using ATT Cascade switches and edge equipment manufactured by Fore will be employed to adapt client traffic into the trunks.

The Prince William County school system has a separate fiber network leased from GTE . The fiber runs between nine of the county's high schools and frame relay circuits are employed to reach 60 additional sites (offices and smaller schools). This network is hubbed at Independent Hill, located on Route 234 halfway between I-66 and I-95.

3.2.12 Potomac and Rappahannock Transportation Commission (PRTC)

PRTC uses basic two-way radio systems to communicate with the bus fleet operators and dispatchers. PRTC does not make use of wireline mediums to communicate with its bus fleet.

3.2.13 Virginia Department of Transportation (VDOT)

VDOT-owned fiber covers 30 miles along I-66, I-395, and a small portion of I-495. The system is currently being expanded by 34.4 miles along I-66 from I-495 to Route 234 and along I-95 from Route 636 to Quantico Creek. In time, fiber will also be extended along I-66 to Gainesville as the High Occupancy Vehicle (HOV) lane is extended to that area. All fiber is being placed in conduit; none is overhead. The new system will also include fiber to the Woodrow Wilson Bridge. Cabin John Bridge cameras feed the TMS over leased T-1 lines.

There is a separate full-motion analog video sub-system using multi-mode fiber to monitor traffic approaching the Woodrow Wilson Bridge. There are a total of nine cameras (five in Virginia and four in Maryland) that are homed to the Smart Travel Center (STC). Twelve strands of fiber extend out from the STC to reach the cameras. Six of these strands extend into Maryland via submarine cable across the Potomac River. Two strands on the Maryland side are not in use and represent a possible communications interface point between VDOT and Maryland State Highway Administration.

VDOT is also installing fiber to bypass the Springfield interchange on I-95. A total of sixteen conduits will be installed and of those, ten will be made available for lease to others. The new system uses single-mode fiber optic cable with SONET technology to achieve an OC-12 data rate. Most trunks consist of 48 fibers. Data and video are carried separately over the fiber, video by analog with video multiplexing. VDOT also has resource sharing projects in progress along the Dulles Access Road Spur, Route 234, and Statewide. VODT entered into statewide resource sharing arrangement in early 2000. This arrangement will provide the NOVA District with access and use of 4 fibers out of a total of 48 fibers along the Capital Beltway.

The some 1500 signals managed by VDOT in NOVA are controlled using communications lines leased from Bell Atlantic. In general, fiber is provided between the District Office and key node locations and copper to the individual devices. The signals are managed from a central location within VDOT facilities located at 3975 Fair Ridge Drive.

Some spread spectrum radio communications are used for VMS along the Fairfax County Parkway, the Beltway near Gallows Road, the Springfield Interchange Project, and at several other locations. All links go back to the STC. There are also some VMS on leased lines and dialup modems along Route 1, Prince William Parkway, Fairfax Parkway, and a few other locations. Radio Controlled Units (RCU) are used inside the Beltway for gates, ramp metering, and some loops.

3.2.14 Metropolitan Washington Airport Authority (MWAA)

Both the Reagan National and Dulles International Airport facilities have an extensive, intelligent infrastructure in place. Roughly 3,200 fiber optic cables have been deployed at Reagan National and roughly 5,000 fiber optic cables have been deployed at Dulles International. Each airport campus has a dual ring backbone running SONET OC-3. The fiber plant at each airport is approximately 10% single mode and 90% multi-mode.

An 800MHz trunk radio system is employed for radio communications between the two airports. Channels on this system are also assigned for communications to the maintenance vehicle fleets serving each airport. This system is also used for a communications link with Loudoun County emergency service providers.

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Operations centers are located on the properties of Reagan National and Dulles International Airports. A collocation study will commence in 2000 to examine the potential for combining both centers. The site of this centralized operations center would be Reagan National Airport.

MWAA is currently studying the feasibility to build new fiber optic cable connecting both Airports along the Dulles Toll Road – I-66 path. Right-of-way is an issue in the Crystal City and Arlington areas. SONET OC-48 technology is envisioned.

3.2.15 Metropolitan Washington Council of Governments (MWCOG)

MWCOG currently has a single administrative LAN employing both NT and UNIX servers. A single T-1 line supports both Internet access and e-mail requirements.

3.2.16 Washington Metropolitan Area Transit Authority (WMATA)

Fiber optic and copper cable are the predominant wireline communications media used for the rail transit systems and utilize resources routed along WMATA's right-of-way. Leased T-1 lines are occasionally used to connect outlying areas of the rail transit system.

A limited amount of microwave communications is used to connect outlying rail transit facilities. The microwave communications are used to connect these facilities with the existing fiber optic cable system. Basic two-way radio communications are provided between the WMATA bus fleet and the Operations Center.

An Operations Center is housed in the basement of the WMATA offices located at 600 Fifth Street, NW, in downtown Washington. Real-time train operations are continuously monitored from this facility. The Operations Center is not hardwired or connected to any outside agency transportation facilities. This center is the main hub for the fiber optic cabling plant.

WMATA is in the process of identifying its future fiber optic cable needs for the next 5-10 years. The study is scheduled for completion in early 2000. While the study can be categorized as "work in progress," it is expected, among many things, to:

♦ Examine current fiber optic cable capacity and identify how to make the best use of it

♦ Identify the need to replace existing rail transit copper communications with fiber optic cable

♦ Identify a set number of cables be set aside for regional sharing purposes with undefined uses

A new digital trunked radio system (490MHz) will be deployed in the early 21st century to replace the current radio communications systems used by the Operations Center staff to communicate with the bus fleet.

3.3 Summary of Existing and Planned Telecommunications Assets

In the preceding paragraphs, existing and planned telecommunications assets of each of the jurisdictions for this report were briefly described. Exhibit 3-2 summarizes this data.

Jurisdiction	Existing Fiber Optic Cable			Planned Fiber Optic Cable		
	Agency Owned Fiber	Leased Fiber	Resource Sharing Fiber	Agency Owned Fiber	Leased Fiber	Resource Sharing Fiber
Arlington County			√			√
City of Alexandria			√			√
City of Fairfax						
City of Falls Church						
DC				√		
Fairfax County			√			√
Frederick County		√		√		
Loudoun County						
MDOT, MD SHA	√		√	√		√
Montgomery County	√		√	√		√
Prince George's County			√			
Prince William County		√		√		
PRTC						
VDOT	√		√	√		√
Regional Bodies						
MWCOG						
National Park Service						
MWAA	√			√		
WMATA	√		√	√		√

Exhibit 3-2. Summary of Existing and Planned Fiber Optic Cable Assets

3.4 Conclusions

Based on the preceding sections, the following conclusions can be reached regarding the state of MWCOG agency and other regional transportation bodies telecommunications assets:

♦ Wireless communications do not exist in a comprehensive fashion that could facilitate the potential sharing of ITS data and information among MWCOG agencies. The Capital Wireless Integrated Network (CapWIN) Demonstration Project will, however, utilize wireless communications to integrate transportation and public safety data and voice communication systems in Maryland, Virginia and the District of Columbia.

♦ Connecting VDOT, MD SHA, and WMATA fiber optic cable systems will allow for regional data sharing and information exchange among MWCOG agencies.

♦ Regional fiber optic cable connections, if fully taken advantage of, could represent a first step in expanding overall transportation planning and operations from a local focus to a more regional context.

♦ Utilization and capacity of agency-owned fiber optic cables or fibers that are either leased or obtained through resource sharing arrangements is not known.

♦ Generally, those interviewed did not know fiber optic hub locations. Since these locations dictate where and how many connections can be made to the fiber optic cable network, the location of the hubs and subsequent fiber optic cable connections(s) will need to be identified for each of the immediate opportunities described in Section 4.

♦ With the exception of VDOT fiber optic cables connecting to its CCTV cameras in Maryland approaching the Woodrow Wilson Bridge, WMATA is the sole MWCOG member agency with fiber optic cable currently spanning the Potomac River. For that reason, completion of the WMATA on-going study that will identify future WMATA fiber optic cable needs and identify cables that could be set aside for regional sharing purposes is essential.

♦ While today WMATA has fiber optic cables spanning the Potomac River, the Net.Work.Maryland initiative, which is currently under construction, will also provide fiber optic cables spanning the river. The physical plant (i.e., fibers in the ground) is scheduled for completion this year in the Fall. 12 strands will be reserved for ITS use. Of these, the number of fibers that might be made available for COG member agencies would have to be determined.

4 Recommendations

Using the data provided in Section 2 and 3 of this report, it is possible to identify opportunities for the sharing of ITS Data as illustrated in Exhibit 4-1.

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┌──────────────────┐
│ ITS Systems that │
│  Generate Data   │
└──────────────────┘

┌──────────────────┐         ┌────────────────────────┐
│    ITS Data of   │         │  Telecommunications    │
│    Interest to   │   ⇒     │  Opportunities for the │
│    Neighboring   │         │   Sharing of ITS Data  │
│   Jurisdictions  │         └────────────────────────┘
└──────────────────┘

┌──────────────────┐
│    Mapping of    │
│ Telecommunications│
│ Assets Available to│
│ Support Data Sharing│
└──────────────────┘
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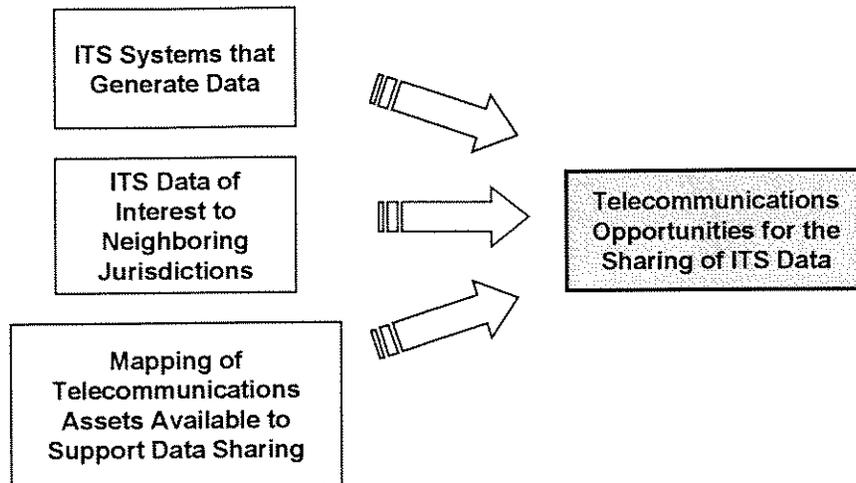
Exhibit 4-1. Process for the Identification of Telecommunications Opportunities to Support ITS Data Sharing

The focus of this study was to identify long-term (vision) and short-term (immediate) opportunities based on existing available assets. As such, the remainder of this section focuses on long-term and immediate opportunities for connecting fiber optic cable networks that are either owned or controlled by state agencies or local jurisdictions including cable provided through lease or resource sharing agreements.

After analyzing the regional assets and developing recommendations, one opportunity was extremely obvious. The development of a regional "backbone" network connecting three primary agencies – MD SHA, WMATA, and VDOT – could provide a foundation for all future regional data sharing efforts. While wireless communications do not exist in a comprehensive fashion that could facilitate the potential sharing of ITS data as noted in Section 3.4, a regional backbone could potentially be the infrastructure to support wireless initiatives. This network is described in greater detail in section 4.3 along with estimated costs.

At the end of the section, several "next steps" are suggested for the sharing of ITS data throughout the region. The regional backbone network is the next logical step to promote immediate opportunities and the long-term vision.

The reader should note that the following recommendations have been made based upon analysis of existing assets and knowledge of trends in ITS research and deployments. MWCOG and its member jurisdictions need to evaluate these recommendations and determine the proper course of action.

4.1 Vision

To facilitate extensive data sharing and information exchange among MWCOG agencies, each agency's operations center should be connected to some type of regional telecommunications

infrastructure. If implemented, the development of a regional fiber optic cable backbone would allow for the VDOT, MD SHA and WMATA operations centers to communicate with each other via a series of connections between existing fiber optic cable networks. In the future, additional fiber optic cable connections that would allow all MWCOG agency operations centers to be connected to a regional fiber optic cable network would serve to further regional data sharing and information exchange opportunities. Such a robust network could help to facilitate a number of initiatives among interested agencies, including:

♦ The exchange of real-time roadway operations data, including CCTV camera images, roadway/weather condition data, traffic signal status, and snow removal vehicle locations.

♦ The exchange of static roadway operations data such as historical freeway, expressway, and arterial traffic count volumes

♦ Coupled with AVL implementation that either exists or is planned by WMATA, the exchange of real-time transit operations data such as the locations of buses and real-time schedule information and the dissemination of it to on-street bus shelters/stops

Looking ahead, potential future fiber optic cable connections could be made as follows:

♦ Connect VDOT fiber optic cable along the Dulles Corridor and/or I-495 corridor with the MD SHA Net.Work.Maryland cable, once the Net.Work.Maryland and VDOT Dulles Access Road Spur fiber initiatives are completed.

♦ Connect VDOT and/or WMATA's fiber optic cable with Fairfax County's INET once it is completed. Given the extent of the County's INET, numerous connection points are likely.

♦ Connect VDOT fiber optic cable to the Prince William DPW facilities, once the planned fiber optic cable along Route 234 is completed.

♦ Connect VDOT fiber optic cable along the I-66 corridor with the City of Fairfax DPW's Signal Shop. New fiber would need to be deployed to the closest available hub or other types of telecommunications would need to be deployed to connect the City of Fairfax to a regional telecommunications system.

♦ Connect VDOT fiber optic cable along the I-95 corridor with the Potomac and Rappahannock Transit Commission's facilities in Woodbridge after the fiber optic cable expansion is completed along I-95. New fiber would likely need to be deployed to the closest available hub, or other types of telecommunications would need to be deployed to connect the City of Fairfax to a regional telecommunications system.

♦ Connecting VDOT fiber optic cable with the two strands of fiber optic cable that the Arlington County DPW will have access to from Cox Cable. Connection(s) would likely occur after replacing the existing coaxial cable with fiber optic cable along the I-66 and I-395 corridors.

♦ Connecting VDOT fiber optic cable with the City of Alexandria INET. Connection(s) would likely occur after replacing the existing coaxial cable with fiber optic cable along the I-395 corridor or along the Capital Beltway.

♦ Connecting VDOT fiber optic cable with the Dulles International Airport. The 48-fiber cable currently being installed along the Dulles Access Road spur between I-66 and Spring Hill Road needs to be completed for this opportunity to come to fruition.

- Connecting Loudoun County DPW facilities with MWAA fiber optic cable at Dulles Airport or in its vicinity. Leased or resource sharing arrangements may need to be pursued by Loudoun County to make this happen.

- Connecting WMATA and Montgomery County fiber optic cable systems somewhere along Rockville Pike or Georgia. Both agencies have fiber optic cable trunks located along these roadways.

- Connecting the MD SHA Net.Work.Maryland cable along the I-270 corridor with the Montgomery County fiber optic cable system at the County Maintenance Facility on Seven Locks Road.

- Connecting the MD SHA Net.Work.Maryland cables with Frederick County's fiber optic backbone that is leased from GS Communications Inc., the county's cable television franchise, at the new County Public Safety Building where the State Police, County Fire and Rescue Operations, and the Sheriff's Department will be collocated.

- Connecting the MD SHA Net.Work.Maryland cable with Prince George's County fiber optic cables that it has access to under a resource sharing arrangement with Comcast Cable, Inc. The County's main government center campus in Upper Marlboro is a potential connection point.

- Connecting the DC DPW operations center at 2000 Reeves Center, 14th Street, to either WMATA or MD SHA Net.Work.Maryland cables.

- Connecting MWCOG to either WMATA or MD SHA Net.Work.Maryland cables.

4.2 Immediate Opportunities

Immediate opportunities have been identified to connect fiber optic cable networks that could allow for data sharing and information exchange among agencies. The immediate focus is on making connections between existing, agency-owned fiber optic cable networks and those fiber optic cables that each agency has access to through lease and/or resource sharing arrangements. From a geographic perspective, VDOT, MD SHA and WMATA fiber optic cable systems provide an opportunity to commence with the development of a regional fiber optic cable backbone that could facilitate regional data sharing and information exchange among MWCOG agencies. Exhibit 4-2, organized geographically, reflects this.

Arlington County

Fairfax County

Loudoun County

Prince William County

City of Alexandria

City of Fairfax

PRTC

MWAA

Frederick County

Montgomery County

Prince George's County

DCDPW

MWCOG

VDOT ↔ WMATA ↔ MD SHA
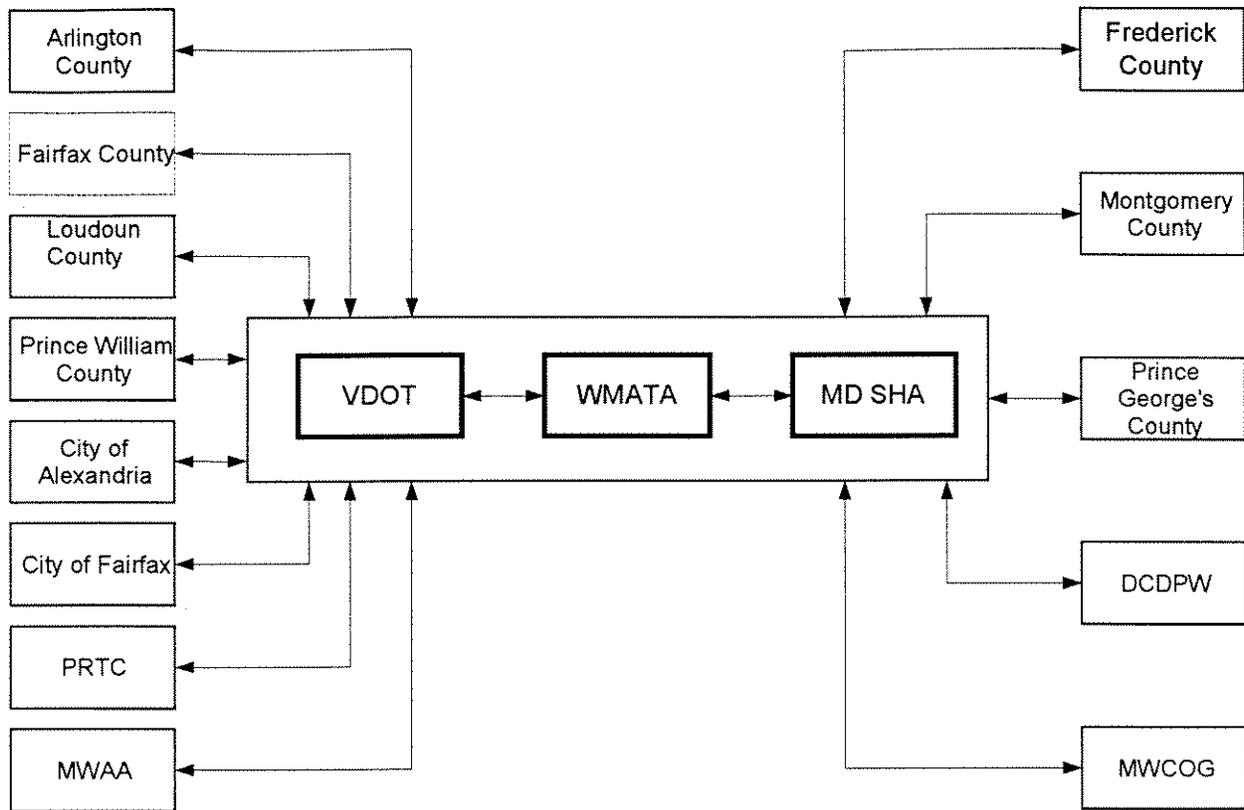
Exhibit 4-2. Immediate Opportunities to Provide Fiber Optic Cable Connectivity

In the short-term, the development of a regional fiber optic cable backbone could facilitate regional and incident and traffic management initiatives along the entire Capital Beltway, the I-95 north-south corridor, and the I-66 / US Route 50 east-west corridor. Connections could be made as follows:

♦ Connect WMATA and MD SHA fiber optic cable systems near the Capital Beltway interchange with the Greenbelt Station, or somewhere along US 50 where it parallels Metro's Orange Line to New Carrollton.

♦ Connect WMATA and VDOT fiber optic cable systems somewhere along I-66, VA Route 110 near the Smart Travel Center, or the Capital Beltway between I-395 and the Woodrow Wilson Bridge. Both agencies have fiber optic cable trunks located along these roadways.

♦ Connect VDOT fibers and Net.Work.Maryland fibers allocated to MD SHA somewhere along the Capital Beltway between the American Legion Bridge and the Dulles Access Road corridor. This connection is an alternative if WMATA is not able to contribute its fiber resources as discussed in the first two bullets.

There are a number of benefits to implementing this backbone as described.

♦ First, limiting the implementation of the backbone to three large agencies minimizes the amount of coordination and agreement necessary for deployment and management of the

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backbone. At the same time, it takes advantage of the experience these organizations have in efforts of this magnitude.

♦ Second, the backbone will provide convenient "hubs" to connect the MWCOG jurisdictions. Virginia counties and cities will connect to the backbone through VDOT. This gives VDOT and the Virginia MWCOG jurisdictions the flexibility to determine the most cost effective and appropriate physical point of connection. Similarly, Maryland counties will be able to connect to the backbone by the virtue of their connection to MD SHA. For DCDPW and COG, they will be able to connect to the backbone via WMATA.

♦ Third, these agencies will be the major entities for future projects such as CAPWin. CAPWin can utilize the backbone for regional communications rather than relying solely on a completely wireless network. This could reduce the amount of wireless infrastructure required. Building this backbone will provide a basis for planning similar regional initiatives.

4.3 Backbone Concept and Estimated Connection Costs

This section provides details of the concept that VDOT, MD SHA, WMATA fiber resources can be interconnected to form an ITS data sharing backbone that can serve the entire MWCOG region. It also presents cost estimates for several connection points that could be implemented in the near-term timeframe.

4.3.1 Backbone Concept

While there are many issues that need to be resolved before a regional ITS backbone becomes operational, the best time to start planning the physical infrastructure to support it is now. A perfect opportunity exists because of all the current resource sharing initiatives in progress within the MWCOG region. While the spare capacity exists, at least 4 fiber strands should be reserved for use by the backbone (2 strands for the primary link, 2 strands for a redundant backup link) and interconnection points should be identified and prepared.

The basis for a regional ITS backbone would be the interconnection of VDOT, MD SHA, WMATA fiber strands set aside for data sharing purposes. In addition to being 3 of the largest agencies with a vested interest in sharing ITS information and technologies, they also possess the most significant fiber holdings. Linking these 3 fiber systems would create a backbone with enough trunks throughout the region to provide convenient interface points to each MWCOG jurisdiction's institutional/governmental network.

4.3.2 Estimated Connection Costs

In Section 4.2, three possible connections between MDOT, MD SHA, and WMATA fibers were identified. This section presents the estimated costs to make these connections. Please note that only the physical infrastructure costs for each connection are estimated, including: fiber optic cable; cable conduits with access hand holes and manholes; fiber splice trays and enclosures; and facilities to house the future communications equipment necessary to use the fiber. The cost of the electronics was not included because there are too many unresolved variables due to operating incompatibilities between the differing ITS technologies, communications protocols, and device types currently in use across the region. As such, maintenance costs of the network cannot be estimated at this time. These questions cannot be answered until data sharing

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agreements have been adopted and inter-agency systems and communications integration engineering analysis has commenced.

The cost estimates for each proposed connection point are presented in Exhibit 4-3 while Exhibit 4-4 identifies the individual components and their costs. This cost data reflects the furnished price, i.e., cost of the materials plus installation. Site surveys were conducted only at MD SHA and VDOT sites. WMATA is in the process of conducting an internal review of fiber resources and was not able to grant access for a site survey at the time of this study. Therefore, cost estimates related to WMATA sites should be considered only as relative budgetary comparison figures. In the absence of survey data, it was necessary to make a number of assumptions about each site. However, enough data exists from the VDOT and MD SHA sites and based on previous projects to present costs that will be within a definitive range. Where appropriate, best and worst case scenarios are presented. The assumptions and scenarios for each connection are discussed in detail in the sections following the exhibits.

Connection Option	Fiber + Conduit		Manholes		Handholes		Splice Enclosures		Equipment Vaults		TOTAL
	Distance	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	COST
WMATA/MD SHA in Greenbelt MD											
Best Case	0.5 mi	$ 48,180	2	$ 5,350	1	$ 1,340	2	$ 8,270	0	$ -	$ 63,140
Worst Case	2.5 mi	$ 240,900	5	$ 13,375	5	$ 6,700	2	$ 8,270	0	$ -	$ 269,245
WMATA/VDOT near the Pentagon											
Best Case	300 ft	$ 10,941	0	$ -	0	$ -	2	$ 8,270	0	$ -	$ 19,211
Worst Case	1 mi	$ 120,410	1	$ 2,675	2	$ 2,680	2	$ 8,270	0	$ -	$ 134,035
MD SHA/VDOT in Northern Virginia											
Alternative 1	.5 mi	$ 48,180	0	$ -	1	$ 1,340	3	$ 12,405	1	$ 79,010	$ 140,935
Alternative 2	1.5 mi	$ 180,616	3	$ 8,025	3	$ 4,020	1	$ 4,135	0	$ -	$ 196,796

Exhibit 4-3. Estimated Total Connection Costs

Component	Unit Cost	Unit
Fiber in trenched 4" PVC Multiducted Conduit	$18.25	per foot
Fiber in bored 4" PVC Multiducted Conduit	$36.47	per foot
Fiber Optic Cable Splice Tray and Enclosure	$4,135	Each
Access Manhole	$2,675	Each
Access Hand Hole	$1,340	Each
Controlled Equipment Vault (power, no electronics)	$79,010	Each
Data Source: 1996 MD SHA cost data reflecting averaged contractor bid tabs, adjusted for inflation at 5%/year		

Exhibit 4-4. Estimated Fiber Cabling Component Costs

4.3.2.1 Connect MD SHA and WMATA fibers:

A connection at the Greenbelt Metro station was selected as the basis for this cost estimate because some details of the MD SHA fiber at this location are known. This fiber terminates at MD SHA's District 3 Headquarters facility on Kenilworth Avenue and spare strands are present. In this area, the fiber parallels the shoulder of the Capital Beltway's outer loop. The Beltway passes over the Metro tracks near the Greenbelt station and the fiber is carried inside a conduit attached to the overpass. There is an access manhole for this conduit on each side of the bridge. It is not known whether sufficient slack exists in either manhole to make the necessary splices there.

The cost estimates are based on the following assumptions:

♦ The connection will link SHA District 3 Headquarters with the WMATA Operations Center at 600 Fifth Street, NW, Washington, D.C. No mid-point amplifier/repeater is required for fiber communications equipment at each end to cover this transmission distance.

♦ WMATA fiber ends at the Greenbelt Metro station and must be extended to reach the MD SHA fiber.

♦ The new connection is laid underground in trenched conduit.

♦ New conduit has an access manhole every ½ mile and an access hand hole midway between each man hole.

♦ In the best case, sufficient slack exists to support splicing into the MD SHA fiber at one of the Beltway overpass manholes (approximately ½ mile).

♦ In the worst case, no usable slack is available and a feeder must be run all the way to District 3 Headquarters on Kenilworth Avenue (approximately 2.5 miles).

4.3.2.2 Connect WMATA and VDOT Fibers

The most likely place for a viable connection point between WMATA and VDOT fibers would either be along I-66 or Virginia Route 110. Metro's Orange line in Virginia utilizes the median of I-66 for the majority of its route, while Metro's Blue/Yellow Line parallels and is in close proximity to VA Route 110. While WMATA and VDOT fibers would be in close proximity along the Capital Beltway in the Alexandria region, a connection made here would result in a circuitous and significantly longer transmission path to reach the STC. Therefore, making a connection in this area is not recommended.

The following assumptions were made:

♦ The connection will link the VDOT STC with the WMATA Operations Center at 600 Fifth Street, NW, Washington, D.C. No mid-point amplifier/repeater is required for fiber communications equipment at each end to cover this transmission distance.

♦ An access point to WMATA fibers is provided at each Metro station.

- One of VDOT's existing cable access cabinets can be utilized to splice into spare fibers.

- The new connection is laid in underground conduit. Because of the presence of the roadways and rail right-of-way, a significant portion of the conduit will have to be drilled/bored.

- The distance between the VDOT fiber access cabinets in the vicinity of the STC range from roughly ½ mile to 2 miles. In the absolute best case, a cabinet is located right by a Metro station. Making the connection could require as little as 200-300 feet of bored conduit.

- In the worst case, the furthest distance a Metro station would be from a VDOT access cabinet is approximately one mile. A 75% trenched, 25% drilled conduit is assumed.

4.3.2.3 Connect VDOT fibers and Net.Work.Maryland fibers allocated to MD SHA

As previously discussed, this connection is an alternative to utilizing WMATA fiber resources. WMATA is in the process of conducting an inventory of their fiber assets and complete data was[1] not available as of this writing. This option has been provided in the event that WMATA is not able to commit its resources to the regional backbone network.

A connection between VDOT and MD SHA could be made in Virginia near the intersection of the Capital Beltway and the Dulles Access Road spur in McLean. Level 3 Communications resource share fibers in Virginia utilized for Net.Work.Maryland run along the Capital Beltway from the American Legion Bridge to Level 3's communications hub facility in McLean. The intersection with the Dulles Access Road spur, along which VDOT resource share fiber is being installed, is approximately a mile from the Level 3 hub building.

This connection would link a future MD SHA communications hub in Gaithersburg with the VDOT STC. The distance between these points (approximately 80 kilometers) is long enough to encounter transmission distance limitations. To service this link, a mid-point facility to host either communications interface or signal amplification equipment will be necessary.

Under the terms of the Net.Work.Maryland resource sharing agreement, there are only 2 possible points to access the MD SHA fiber in Virginia: an access/interface manhole near the American Legion Bridge or the Level 3 Communications Hub where rack space is being leased for MD SHA communications equipment. This leads to 2 possible alternatives for making a connection between VDOT and MD SHA which are discussed below.

The first alternative is based on the assumption that VDOT also has access to resource share fibers along the Level 3 trunk to the McLean Communications Hub. If so, a splice between MD SHA and VDOT fibers could be made in the manhole at the American Legion Bridge. These fibers in turn would be spliced into VDOT's fiber along the Dulles Access Road Spur. A small, environmentally controlled, prefabricated hut would also be erected here to house the necessary communications equipment to interface MD SHA and VDOT data transmissions.

The following additional assumptions were made for the cost estimate:

- ½ mile new conduit and fiber is needed to connect between the 2 closest access manholes for each fiber trunk and the equipment hut.

- There is 1 intermediate access hand hole in the conduit.

- The new conduit can be 100% trenched.

The second alternative is to make the connection between MD SHA and VDOT at the Net.Work.Maryland termination point at the Level 3 Communications Hub. Additional rack space would have to be leased to install the interface communications equipment, but the connection should then be a simple matter of patching between devices in the racks. A connecting fiber from the Level 3 facility to reach VDOT's Dulles Access Road Spur fibers would also be necessary. This alternative trades off the cost of a longer conduit run versus building a separate communications hut as proposed in Alternative 1.

The following assumptions were made for the cost estimate:

♦ VDOT does not have access to fibers on the Level 3 route

♦ Because the Level 3 Hub is in a highly developed area, there are probably roadways that the conduit will have to be bored/drilled. A 75% trenched, 25% drilled conduit is assumed.

♦ The conduit length is 1.5 miles.

♦ New conduit has an access manhole every ½ mile and an access hand hole midway between each manhole.

4.4 Next Steps

While much of the information presented in this report is "high level" in nature, the design of a regional fiber backbone network provides another level of detail for MWCOG jurisdictions to take the next steps for developing the backbone. While the decision of implementing the regional backbone network is pending, other issues need to be considered. Specifically these are:

♦ Technology impacts: Both analog and digitally compressed video transmission methods are used to forward CCTV camera images in the region, and not all of the agencies in the region are equipped to accommodate both transmission methods.

♦ Architecture: An analysis needs to determine whether the connections of fiber optic cable systems set forth in Section 4.1, Vision, and Section 4.2, Immediate Opportunities, are consistent with current and anticipated local and regional ITS architectures.

♦ Prioritzation: MWCOG jurisdictions need to take the information in this report and begin to prioritize the functions and applications that will yield the most benefit from being shared across the region. These applications will be important when determining pilot projects for the proposed regional backbone network or using existing telecommunications infrastructure.

In addition to these issues, there is a need for greater regional focus if the sharing of ITS data is to be effective. Moreover, since telecommunications is the "glue" that makes the sharing of this data possible, a permanent MWCOG Subcommittee on Telecommunications Support for the Sharing of ITS Data should be established to develop a Regional Fiber Optic Cable Master Plan. The MWCOG Subcommittee on Telecommunications Support would provide oversight for the implementation of the regional backbone network and to ensure technical issues are resolved to the satisfaction of MWCOG jurisdictions.

If the MWCOG jurisdictions approve of the regional backbone network the following steps can be taken to proceed towards implementation:

♦ An agreement needs to be forged between MD SHA, WMATA, and VDOT to implement the proposed backbone network.

♦ Engineering of the fiber optic cable connections needs to commence to advance the development of the regional fiber optic cable backbone concept.

♦ Pilot projects need to be approved by MWCOG jurisdictions.

In conclusion, the regional backbone network can represent a showcase of regional cooperation and provide a model for other metropolitan areas throughout the U.S. for initiatives to improve transportation, safety, and quality of life.

Acronym List

Acronym	Term
ATM	Asynchronous Transfer Mode
ATMS	Advanced Traffic Management System
AVL	Automatic Vehicle Location
CCTV	Closed Circuit Television
CHART	Coordinated Highways Action Response Team
CSC	Computer Sciences Corporation
CUE	City University Energy Saver Transit System (City of Fairfax)
DMS	Dynamic Message Sign
DOT	Department of Transportation
DPW	Department of Public Works
DPWT	Department of Public Works and Transportation
ECC	Emergency Communications Center
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPS	Global Positioning System
HAR	Highway Advisory Radio
HOV	High Occupancy Vehicle
INET	Institutional Network
ITI	Intelligent Transportation Infrastructure
ITS	Intelligent Transportation System
Mbps	Million bits per second
MD SHA	Maryland State Highway Administration
MDT	Mobile Data Terminal
MHz	Megahertz
MIST	Management Information System for Transportation
MWA	Metropolitan Washington Area
MWAA	Metropolitan Washington Airport Authority
MWCOG	Metropolitan Washington Council of Governments
Net.Work.Maryland	Maryland's Planned, State-wide Fiber Optic Backbone Network
NMS	Network Management Services
NOVA	Northern Virginia
OC-12	622.08 Mbps (optical carrier data transmission rate)
OC-3	155.52 Mbps (optical carrier data transmission rate)
OCR	Optical Character Recognition
PBF	PB Farradyne
POTS	Plain Old Telephone Service
PRTC	Potomac and Rappahannock Transportation Commission
RCU	Radio Controlled Units
RWIS	Roadway Weather Information System

Acronym List (Cont.)

Acronym	Term
SOC	State-wide Operations Center
SONET	Synchronous Optical Network (high-speed, fiber-optic transport standard)
SSR	Spread Spectrum Radio
STC	Smart Travel Center
T-1	1.544 Mbps trunk line
TAR	Traffic Advisory Radio
TCC	Transportation Coordinating Council
TMC	Transportation Management Center
TMS	Traffic Management System
TOC	Transportation Operations Center/Traffic Operations Center
TRIP	Traffic Response and Information Partnership
US DOT	US Department of Transportation
VDOT	Virginia Department of Transportation
VMS	Variable Message Sign
WMATA	Washington Metropolitan Area Transit Authority

Appendix A – Interview Reports

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Arlington County Department of Public Works (DPW)
Date/Time:	November 3, 1999 – 1:30 PM to 3:00 PM
Location:	#1 Courthouse Plaza, 2100 Clarendon Blvd. Suite 717, Arlington, VA 22201
Attendees:	Ken Hook, Deputy Director, Department of Public Works, 703-228-3702, khook@co.arlington.va.us
	Joseph M. Durkee, Jr., Traffic Engineer, DPW, 703-228-3721, jdurke@co.arlington.va.us.
	Eric Smith, DPW, 703-228-3692, rsmith@co.arlington.va.us.
	Andre P. Conerly, DPW, Traffic Systems Specialist, DPW, 703-228-3727, aconer@co.arlington.va.us.
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Dan King, Senior Consulting Engineer, CSC, 410-691-6724, dking2@csc.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Darrell Shahin, 11/29/99 (Draft), 12/21/99 (Final)

1   Purpose of Interview

Mr. Arch explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. Arlington County is a key "stake holder" in this process and as such was identified for interview.

2   Responsible Organizations

The Arlington County government is organized into departments, which themselves are divided into divisions. The Department of Public Works (DPW) is responsible for administering and operating the County's transportation systems and for maintaining roadways. There are few state-owned roads in the County, hence, DPW is responsible for most of the roadways within the jurisdictional boundary. Responsibilities for county-wide transportation planning, roadway maintenance, signal systems, transit services, plowing operations, etc. are assigned to various DPW divisions. DPW's offices are at #1 Courthouse Plaza, 2100 Clarendon Blvd.

The Office of Information and Technology Services is responsible for the administration of county data processing systems including the LAN utilized by the DPW. The Acting Director of that Office is Ron Carlie.

3 Existing and Planned ITS Capabilities and Needs

3.1 Signal Systems

Two signaling systems are deployed in Arlington County. The SCOOT system is used along the Jefferson Davis corridor, Columbia Pike, US 50, and roadways in the Balston area. The remainder of the signals are controlled using the Eagle MONARC system. Corresponding signal control computers and workstations for each system are located in the DPW computer room on the seventh floor at 2100 Clarendon Boulevard. There is currently no interoperability capability between the two systems. Other than the real time data collected and processed by the SCOOT system, no other traffic data is being collected using the signal systems. DPW would like to eventually expand SCOOT to all of the major routes in the county, especially Lee Highway.

Communications to the signals is over a twisted-pair copper fiber plant. All copper is owned, none leased. Nearly all of the signals are connected via the twisted-pairs. There are a few isolated signals controlled by a simple time-of-day routine running locally on the signal's controller.

Arlington DPW has a cooperative relationship with VDOT concerning signal coordination with VDOT-controlled signals near the County boundaries. VDOT has permitted the County to assume control of some of their signals at nearby key intersections on roadways leading into Arlington. There currently are no efforts regarding signal coordination at the Arlington/Alexandria border.

The SCOOT system was installed in anticipation of implementing adaptive timing routines and signal priority/preemption capabilities. Arlington will be a participant in the ITS prototype study for regional signal preemption for emergency and fire service vehicles (police vehicles are currently excluded) and signal priority for buses. A Federal earmark and state funding have been approved. The study will be conducted by the Virginia Polytechnic Institute's Transportation Studies Center. The bus priority signaling demonstration will be implemented in Arlington along Columbia Pike. The emphasis will be on priority timing for far-side stops.

3.2 Video

The County has a single traffic surveillance camera located at the intersection of Wilson Blvd. and Lynn Street in Rosslyn. The viewing monitor and the camera control console are located in the DPW computer room. The equipment is manufactured by Diamond Electronics. The camera was installed as an experiment to test the quality of video transmitted over the existing twisted-pair cable plant. The video quality is considered very good by DPW personnel. Deployment of additional cameras using the twisted-pair, while desired, is not likely due to capacity constraints and signal transmission distance limitations.

There has been coordination between VDOT and DPW concerning placement of VDOT's cameras within the County. DPW is preparing a list of suggested camera locations for VDOT's consideration. DPW expects it will be several years before these camera sites are installed.

When asked if they would be interested in receiving video from VDOT cameras, meeting participants responded positively. DPW would be most interested in those cameras that would provide a view of traffic coming off the highway ramps leading into the County street network. It was also reported that the Arlington Police Department has expressed interest in having video available in their Emergency Communications Center (ECC). The ECC is located in a neighboring building in the Courthouse Plaza complex.

3.3 Other Roadway Systems

Arlington has one roadway that employs reversible lanes (Washington Blvd. At Wilson Blvd). The lane control signals are managed locally by a time clock. The long-term goal is for the eventual elimination of this system through road improvements that will add additional travel lanes.

There are no additional ITS devices installed in the County that are DPW's responsibility. DPW has no plans to install any, principally because there are VDOT controlled ITS devices along the highways passing through the County, with more scheduled for installation.

County vehicles are not equipped with AVL or GPS. Installation of a GPS system was anticipated last fiscal year, but funding was not approved. Although the request was not renewed this year, installation of GPS/AVL remains a future goal.

3.4 Transit Systems

Transit in Arlington is principally provided by WMATA's MetroBus and MetrolRail systems. MetroBus routes in Arlington were not affected by the forces that resulted in most of the other MWCOG jurisdictions assuming bus service responsibilities. Arlington has a very close working relationship with Metro concerning the routes and schedules in the County. Metro service in the county is actually marketed as "Arlington Metro". Arlington has further cooperated with Metro by assuming responsibility for most of the bus stops in the county. Of the some 200 bus stop shelters, Arlington owns and maintains around 140 of them. Additionally, the county does operate 2 feeder loop bus routes serving the MetroRail stations at Crystal City and Rosslyn.

As evidenced by the installation of the SCOOT system and participation in the signal priority/preemption study, Arlington is a firm believer in signal priority for buses. DPW will be evaluating all of the bus stops in the county. The goal is to maximize the number of far-side configuration stops that can be implemented. Signal priority coordination is more efficient at intersections where the bus stop is at the far-side (i.e., beyond the signal) of an intersection.

DPW is also very interested in real-time traveler information displays at bus stops. In the near term, DPW would like to deploy displays showing static schedule information. Incorporating real-time schedule status would be dependant on implementation of AVL on the MetroBus fleet (not expected for several years).

DPW is currently working on a Transit Master Plan. It is currently in the final draft stage. Once finalized and released, it will clearly identify Arlington's future transit goals.

4 Existing Telecommunications

4.1 Fiber

DPW currently has no fiber resources. Through a resource sharing agreement with Cox Cable, Arlington is deploying a fiber optic network throughout the county. Two strands of dark fiber will be assigned for use by DPW for the signal system. Personnel in attendance did not know additional details of this network concerning total strand counts, transmission protocol, and data rates. Once the strands are available, DPW will have to develop a strategy to migrate the signals to the fiber.

4.2 Wireline

In addition to the twisted-pair cable plant, there are no significant wireline resources other than POTS voice circuits. The County will be initiating a study of its signal communications system in the near future. Funding for this study has been approved through the use of CMAQ monies.

4.3 Wireless

The County has an 800MHz radio system. Channels are assigned to the various County agencies and emergency service organizations. Each county government department has at least one assigned channel and the ability to switch between all channels except those controlled by fire and police.

4.4 Inter-Agency Connectivity

Arlington used to have a communications link to the VDOT's former traffic management center and received information from various VDOT systems. This link was broken when VDOT built the Smart Travel Center and connectivity has not been restored. Other than meeting participation and phone lines, DPW has no network connectivity to any other regional transportation authorities. Arlington participants suggested that signal coordination with Alexandria would be of interest but that the communications links were not available to support that effort. There may also be interest on VDOT's part in obtaining some of the traffic data being collected and stored in SCOOT.

5   Action Items

The following action items resulted from the meeting:

♦ CSC/PBFI will provide Mr. Hook with a draft of this interview report for review to ensure the accuracy of the information contained herein.
♦ CSC/PBFI will follow-up with Ron Carlee to identify whether DPW offices at 2100 Clarendon Boulevard will be served by fiber optic cable as well as other topology issues

Distribution

All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with City of Alexandria Department of Transportation and Environmental Services
Date/Time:	November 18, 1999 – 1:30 PM to 3:00 PM
Location:	Alexandria City Hall, P.O. Box 629, Alexandria, VA 22313
Attendees:	David Jones, Transportation Division, Transportation and Environmental Services Department, 703-838-4076, david.jones@ci.alexandria.va.us
	L.A. McCracken, Transportation Division, Transportation and Environmental Services Department, 703-838-3800, la.mccracken@ci.alexandria.va.us
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Darrell Shahin, 11/29/99

1   Purpose of Interview

Mr. Arch explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. The City of Alexandria is a key "stake holder" in this process and as such was identified for interview.

2   Responsible Organizations

The City of Alexandria government is organized into five departments, which themselves are divided into divisions. The Transportation Division is part of the Department of Transportation and Environmental Services. It is responsible for administering and operating the city's transportation systems and for maintaining roadways. There are no state-owned roads in the city; hence, the Transportation Division is responsible for all of the roadways within the jurisdictional boundary. The Transportation Division has a Transportation Operations Center (TOC) located at City Hall on the ground floor.

3   Existing and Planned ITS Capabilities and Needs

3.1   Signal Systems

Alexandria has an existing Eagle MONARC signal control system which is being phased out. Eagle ACTRA is the new signal system. ACTRA is "NT-based" and introduces expanded capabilities for traffic counting, plus control and communications to variable lane control devices, weather monitoring stations, and dynamic messaging signs. Communications to most of the signals is over a city-owned twisted-pair copper cable plant. There are approximately 220 signals in the city, 160 of which are on the signal system. The remaining signals should be integrated into the system within a year. Of these, it is expected that some signals (10 or so) cannot be reached over the twisted-pair plant and will remain as isolated intersection operations. Of the remaining 50 signals, the City is currently studying

communications alternatives to these signals, including radio and possibly linking to the city's fiber network.

Traffic counts on boundary roads are conducted annually using temporarily deployed rubber tube counters. This is currently the only regularly collected traffic data. Concerning the boundaries, there has been no effort to date for coordination with signals in neighboring jurisdictions.

3.2   Video

The City has a single traffic surveillance camera. The camera is manufactured by Cohu and uses digital subscriber line technology. It had been installed as a demonstration to test video transmission over the twisted-pair plant. The viewing monitor and the camera control console are located in the TOC. The video quality is considered very good and the installation is deemed successful. Additional cameras are going to be acquired. In fact, two cameras from a competing vendor have already been ordered.

The City is also experimenting with video detection for signaled intersections. A test bed has been installed at one intersection using a single camera. If successful, the Transportation Division would desire widespread usage to reduce future maintenance costs associated with in-pavement sensor loops.

When asked if they would be interested in receiving video from VDOT cameras, meeting participants responded positively. They also indicated that they'd also like to see continued future deployment of city-owned cameras.

3.3   Other Roadway Systems

There are two VDOT weather/roadway sensor stations in the city (Seminary Road at I-395 and US 1 at Franklin Street). The traffic maintenance shop, located at the intersection of Quaker Lane and Colvin Road, has a communications link to VDOT over which it receives the SSI SCAN weather monitoring service. City maintenance vehicles are not equipped with AVL or GPS. Snow removal operations are coordinated from the maintenance shop.

The Transportation Division is very interested in improving their traffic counting capabilities as an aid to implementing adaptive traffic management strategies and improving incident management strategies. They have started collecting some dynamic traffic volume data. 80-90 detectors with counting capabilities had previously been installed in conjunction with the old mainframe system. Over the years, they had fallen into disrepair. Some of these sites have recently been resurrected and the TOC is receiving data from them. Some other sites are also under consideration for re-activation. The Transportation Division also has recently installed an EIS side-fire microwave radar, principally for use as a traffic counter. It was also reported that they are looking into using cameras for counting also. During the interview, a desire for improved traffic data sharing with neighboring jurisdictions was also expressed.

Finally, the Alexandria Police administers a photo red light system within the city. One camera is rotated between three intersections equipped for the system.

3.4   Transit Systems

In addition to MetroBus, bus services within the city are provided by DASH. DASH is a private entity owned by Alexandria. City oversight of DASH is accomplished by having the City Manager sit on the DASH Board of Directors. DASH vehicles currently are not equipped with AVL or GPS.

4   Existing Telecommunications

4.1   Fiber

Eight years ago, Jones Intercable (now owned by Comcast) replaced copper cabling with fiber optics and provided the city with a fiber infrastructure via a resource sharing agreement. Fiber drops are located at most city administrative facilities, schools, libraries, fire/police stations, and other public buildings. This network is called the Institutional Network (INET). While the cabling is complete, integration of sites onto the fiber is about 2/3 completed. Fiber is OC-3, SONET.

INET fiber drops have been provisioned in a number of communications closets at City Hall. The TOC has been connected to the INET via the ground floor communications closet. The TOC communicates with the traffic maintenance facility via the INET.

4.2   Wireline

In addition to the twisted-pair cable plant, there are no significant wireline resources other than POTS circuits used for voice.

4.3   Wireless

The city has an 800 MHz radio system. Channels are assigned to the various city agencies and emergency service organizations, including the Transportation Division.

4.4   Inter-Agency Connectivity

Other than the maintenance shop link to VDOT for SCAN, the Transportation Division has no connectivity to other regional transportation agencies.

5   Action Items

The following action items resulted from the meeting:

♦   CSC/PBFI will provide Mr. Jones with a draft of this interview report for review to ensure the accuracy of the information contained herein.
♦   Mr. Jones to provide CSC/PBFI with a map illustrating the INET.

Distribution

All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with City of Fairfax Department of Public Works (DPW)
Date/Time:	October 27, 1999 - 1:00 PM to 2:30 PM
Location:	City of Fairfax, DPW Offices
Attendees:	John Veneziano, Director of Public Works, City of Fairfax, 703-385-7810, jvenezia@ci.fairfax.va.us
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Jeff Arch, 11/02/99

1 Purpose of Interview

In support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information within the Region. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. The City of Fairfax Department of Public Works (DPW) is a key "stake holder" in this process and as such was identified for interview. Mr. Veneziano represented the DPW during this interview.

2 Responsible Organizations

DPW, which is one of nine City of Fairfax Departments, is the sole organization within City Government that has a significant interest in ITS and the ITS infrastructure. The DPW Streets Division is responsible for carrying out snow removal and traffic signal system operations. The Transit Division is responsible for operating the City's bus systems, paratransit system, and Metro Access program (regional paratransit program). The Operations Division is responsible for all City vehicular fleet maintenance activities, including the bus fleet.

3 Existing and Planned ITS Capabilities and Needs

Mr. Veneziano described these systems during the interview and made the following remarks in elaboration:

3.1 Roadway Systems

The DPW is responsible for developing, operating and maintaining the City of Fairfax's traffic signal system. An Eagle system was installed in stages, beginning in the mid-1980's, then upgraded to an Eagle MONARC system that was completed in the early 1990's. The communications medium is twisted-pair copper cable. All operations are overseen from the City's Signal Shop facility located at 3410 Pickett Road. The signal system can collect traffic volumes, but currently is not set up to do so. City staff

routinely uses a portable laptop computer to communicate with the system. Mr. Veneziano supplied a map (undated) of the traffic signal system, which illustrates signal locations and overhead and underground communications lines.

The City is waiting on the approval of funding from the Transportation Coordinating Council (TCC) to deploy up to seven CCTV cameras. If deployed, the cameras would be operated from the Signal Shop located at 3410 Pickett Road. The communications medium is unknown at this time, but could include leased lines or the existing twisted-pair copper cable. The use of fiber optic cable newly installed or leased, is unlikely for this purpose.

The City has no existing or planned Highway Advisory Radio (HAR) or Variable Message Signs (VMS). The City carries out their own snow removal program. No Roadway Weather Information System (RWIS) or Automatic Vehicle Location (AVL) systems exist. The City is currently preparing a grant to secure funding for an AVL system, but it likely won't be deployed for 3-5 years. When asked whether he'd like to deploy additional devices, Mr. Veneziano indicated he's interested in using pavement temperature sensors that could be supported by the existing MONARC system.

3.2   Transit Systems

DPW's Transit Division operates the City University Energy (CUE) Saver transit system. CUE runs seven days a week along two set routes with average headways ranging from 15-30 minutes. Both routes service the George Mason University campus and the Vienna Metrorail station along I-66. A March 1, 1998 Bus Routes and Schedules map was provided by Mr. Veneziano. In addition to distribution of printed schedules, the CUE schedule is also posted on the city's Web page.

The Transit Division also operates the city's paratransit system. The city provides its own in-town service called City Wheels and is a participant in the Metro Access program (regional paratransit program).

When asked what he would most like to see come out of this telecommunications study, Mr. Veneziano suggested information that would facilitate relaying real-time bus schedule status information to bus shelters. He also indicated they are studying coordinated Smart Fare technology with connecting transit services (principally, MetroBus and MetroRail).

4   Existing Telecommunications

In response to specific interview questions regarding existing telecommunications capabilities, Mr. Veneziano responded as summarized below.

4.1   Wireline

Twisted-pair copper cable is used for the traffic signal system. While the City has no fiber optic cable system of its own, Bell Atlantic has a building located in the southeast quadrant of the Route 50/123 intersection that is served by the majority of existing private fiber optic cable systems in the area. Mr. Veneziano reported that five service providers are currently laying fiber within the city limits. The City plans to develop leased line communications between City Hall and 3410 Pickett Road and will consider leasing additional communications when necessary.

4.2   Wireless

Telephone and radio systems comprise the City's wireless communications capabilities. A dedicated radio frequency is reserved for the CUE system and one is dedicated for vehicle to vehicle operations. Key staff have pagers and cellular telephones. Additional pagers may be acquired to support incident management coordination with VDOT in the near future.

4.3 Facilities

The City's Signal Shop is located in the Property Yard at 3410 Pickett Road. An Emergency Command Center is also located adjacent to the Signal Shop within the compound. Beyond telephone service, no other communications medium connects buildings and facilities in the compound.

5 Future Telecommunications Infrastructure

The City is currently preparing a Master Transportation Plan that should be completed in May 2000. A goal of the plan will be to support the use of advanced technology to operate the City's roadway and transit systems.

6 Actions Items

♦ CSC/PBFI to provide John Veneziano with a draft of the interview report for his comments/corrections as required.

Distribution - All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with District of Columbia (DC), Department of Public Works, Division of Transportation Personnel
Date/Time:	April 10, 2000
Location:	2000 14th Street, NW, Washington, DC 20009
Attendees:	Kamal Hamud, Systems Engineer/ITS Specialist, Traffic Management Center, Design, Engineering Construction Administration, 202-671-1496, khamud@wam.umd.edu
	Harvey Alexander, Electronic Mechanic, Traffic Management Center, Design, Engineering Construction Administration, 202-671-1490
Prepared By:	Dan King (4/11/00)

1   Purpose of Interview

In support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. The District of Columbia is a key "stake holder" in this process and as such was identified for interview.

2   Existing and Planned ITS Capabilities and Needs

The only ITS system in use by DC today is their signal system, although new video and data systems to assist with incident, freeway, and bridge management are planned. It is the intent of DC officials to establish a state-of-the-art Traffic Management Center for the city within the next five years.

The signal system was recently upgraded to Quicnet, Version 4, manufactured by BI Tran Traffic Management Software Control Technologies. Approximately 1,500 signals are controlled throughout the city and visually displayed on computer screens in the Traffic Management Center located on the 2nd floor of Department of Public Works building located at 2000 14th Street. In addition to visually showing the status of all signals, the system is capable of providing information on traffic volumes. The system also provides for signal preemption (at 21 locations), which is employed by DC fire fighters and other emergency response personnel.

Looking towards the future, there is an on-going project with Dunn Engineering Associates of NY to develop a fully integrated ITS system for DC. This work is to be done in accordance with the National ITS Architecture. According to Mr. Hamud, Federal Highway Administration funds have already been identified and allocated for this purpose. BI Tran is a member of the Dunn team so it is assumed that the current Quicnet system will be subsumed by the future work. Messrs. Hamud and Alexander indicated that the initial Dunn work will emphasize incident, bridge, and freeway management.

In addition to the work with Dunn, DC is also working with WMATA on a pilot project for signal preemption and DC expects to be a test bed for this initiative.

3 Existing and Planned Telecommunications

All signal wiring is currently copper. However, Dunn has been tasked with developing a fiber optic system to support signals and other ITS needs. Mr. Alexander indicated that this fiber will follow existing routes, using existing conduit. No use of other fiber (WMATA or otherwise) is anticipated. Dunn is expected to have a design for this new fiber system by the end of 2000.

4 Data Sharing

No signal data is currently shared with others jurisdictions with the exception of a pilot project with Montgomery County for the synchronization of signals along Wisconsin Avenue at the DC line. Not withstanding this fact, Mr. Hamud supports such data sharing and, as the DC system matures, he anticipates a need to share signal, incident, freeway, and bridge data/video with a number of organizations and jurisdictions including the Park Police, DC Police, Transit authorities, Montgomery County, Prince George's County, and Virginia.

Mr. Hamud feels that once DC has its fiber in place to support the new ITS system, it will then be in a position to cooperate in the sharing of data and video. Such sharing would be on an equal footing with MDOT, VDOT, and WMATA. In fact, Mr. Hamud thought that DC's future fiber might be useful in providing connectivity between these adjacent jurisdictions. The DC Traffic Management Center is located just two blocks from the WMATA U Street/Cardozo Metro Station.

For now, Messrs. Hamud and Alexander said that the sharing of ITS data is a future goal while their immediate problem is one of developing and implementing a state-of-the-art ITS system for DC.

Distribution

All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Fairfax County Department of Transportation
Date/Time:	October 27 - 9:00 AM to 12:00 PM
Location:	12000 Government Center Parkway, Fairfax, VA
Attendees:	Carlos Escobar, Director, Network & Computing Services Division, 703-324-3864, cescol@co.fairfax.va.us

Doug Hansen, Fairfax County Department of Transportation (DOT), 703-324-1178, douglas_hansen@hotmail.com

Andy Szakos, Fairfax County DOT, 703-324-1194, andry.szakos@co.fairfax.va.us

Cleathan Lewis, Fairfax County Department of Information Technology (DIT), 703-324-3859, clewi1@co.fairfax.va.us

Wanda Gibson, Fairfax County (DIT), 703-324-4778, wgibso@co.fairfax.va.us

Ward Zerbe, CSC, 410-691-6713, wzerbe@csc.com

Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com

Bobbie Sharma, Engineering Associate, PBFI, 301-984-6461, sharma@pbworld.com

Prepared By: Darrell Shahin, 11/19/99 (Draft), 12/21/99 (Final)

1 Purpose of Interview

Mr. Zerbe explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. Fairfax County is a key "stake holder" in this process and as such was identified for interview.

2 Responsible Organizations

Two Fairfax County government departments were represented at the meeting. The Department of Transportation (DOT) is responsible for county-wide transportation planning, maintenance of county roads, operating the county's transit services, and plowing operations. Fairfax DOT is also involved with localized issues, such as parking and traffic cut-through concerns, many of which are in response to citizen requests and complaints. Fairfax DOT is an active participant in a number of VDOT's ITS initiatives in Northern Virginia.

The Department of Information Technology (DIT) is responsible for the County's information management, data processing, networking, computing, and telecommunications resources. As such, they are responsible for providing and maintaining said capabilities for Fairfax DOT.

VDOT is responsible for state-owned roads and the traffic signal system in Fairfax County. In Virginia, incorporated cities are independent jurisdictions. These towns within (and bordering) the County, such as the cities of Fairfax, Falls Church, and Alexandria are responsible for transportation services, roadways, and signal systems within their jurisdictional boundaries.

3   Existing and Planned ITS Capabilities and Needs

3.1   Signal Systems

As mentioned earlier, VDOT is responsible for the traffic signal system in Fairfax County. The signal control system is based on the Management Information System for Traffic (MIST) technology. The signal system is currently running time-of-day signaling routines. Efforts are underway to activate the counting capabilities of the signal detectors at each intersection. Some intermediate detectors, called system detectors, have also been installed to sense traffic thresholds between intersections. Video detection is also being examined for it's long term maintenance cost savings over traditional loop detectors in the pavement.

Fairfax DOT has a cooperative relationship with VDOT concerning the management and timing of the signals. In fact, the installation of a MIST terminal in Fairfax DOT's offices in the County government center is in progress. This terminal will enable Fairfax DOT to observe the timing cycles and access other data collected by the system such as traffic counts. Fairfax DOT would like to see MIST's capabilities to run incident management routines and adaptive timing routines be implemented.

Fairfax DOT is also a participant in the ITIS prototype study for a regional signal preemption system for emergency and police vehicles. A Federal earmark and state funding have been approved. Fairfax DOT is waiting for Transportation Planning Board (TPB) approval. The study will be conducted by the Virginia Polytechnic Institute's transportation studies center. Fairfax would like to see the US Route 1 corridor be selected as the prototype route for the study. Arlington County will be participating in this study to test bus priority signaling.

3.2   Other Roadway Systems

Photo red-light is being deployed. The current plan is to have 10 cameras rotated around the county. Equipment employing the wet film process was selected on the basis of it being a field-proven technology.

An ITS grant was received to study illuminated crosswalks. This technology will be installed at crosswalks at unsignaled locations. Lights embedded in the pavement will be illuminated when sensors detect pedestrians using the crosswalk. A related activity that Fairfax DOT would like to have funded in the future is automation of school warning flashers.

A full array of ITS devices (cameras, advisory radios, messaging signs, etc.) have been deployed by VDOT. There are no plans to install additional County-owned devices. The County's maintenance fleet is not AVL-equipped and communications are via radio. Fairfax DOT would like to implement AVL, but this is considered a long term goal.

3.3 Transit Systems

Fairfax DOT operates the Fairfax Connector fixed-route bus system. Fairfax County Community and Recreation Services operates the FASTRAN para-transit system. FASTRAN operates a small number of fixed routes in addition to individual call services. To date, implementation of ITS has been limited. Some technologies were employed to identify traffic flows for route determination for the Fairfax Connector service. The results were inconclusive. Neither service fleet is AVL-equipped. Communications to both is via radio.

Fairfax DOT is interested in the eventual implementation of AVL-based real-time schedule and status information system for both systems. An interest in participating with a seamless smart fare system covering regional transit systems was expressed. It was also reported that FASTRAN also needs a better way to count passengers and provide drivers dial-out capabilities to call passengers who are not at the stop when the vehicle arrives.

Other interests include providing more information to the public regarding parking garage availability, bus schedules, and other information that will promote use of transit systems.

4 Existing Telecommunications

4.1 Fiber

Through a resource sharing agreement with Cox Cable, the County is deploying an extensive fiber optic network called the Institutional Network (INET). The INET will connect some 400 County offices, public facilities, and schools and is scheduled for completion in May, 2002. It will feature an OC-48 backbone and will provide data, voice, and video services. Six strands of fiber will be made available at each site on the INET. INET connectivity will also be extended to additional sites via leased services from public providers. All of the fiber will be laid underground.

Reston will not be on the INET initially because it is in another cable operator's region. It also was reported that Herndon and the City of Fairfax are installing fiber, but details of these activities were not available.

The INET will principally be used for County enterprise networking, voice services, and public service and school video applications. Meeting participants reported that no ITS applications are planned in the initial INET deployment. While interest in the possibilities of using the INET for ITS was expressed, it is not known at this time whether future opportunities to utilize the INET for ITS would exist.

4.2 Wireline

Outside of traditional phone lines, there are no significant wireline resources employed for dedicated use by Fairfax DOT.

4.3 Wireless

Fairfax DOT's maintenance fleet and the transit services use channel's assigned from the County's existing radio system.

5 Action Items

The following action items resulted from the meeting:

A-15

♦ CSC/PBFI will provide Mr. Escobar with a draft of this interview report for review to ensure the accuracy of the information contained herein.

Distribution

All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Department of Public Works (DPW), Frederick County Maryland
Date/Time:	November 2, 1999 – 1 PM to 3 PM
Location:	Frederick County DPW, 1st Floor, 118 North Market St., Frederick, MD
Attendees	Al Hudak, Frederick County DPW, 301-696-2928, al_hudak@co.frederick.md.us
	Neil Spiller, Traffic, Frederick County DPW, 301-696-2930
	Jim Gugel, Frederick County Planning, 301-694-1144, jim_gugel@co.frederick.md.us
	Gwen A. Courtney, Telecommunications Services Manager, Interagency Information Technologies, 301-694-2505, gwen_courtney@co.frederick.md.us
	Sherry C. Burford, Director, Transit Services of Frederick County, 301-694-2065, sherry_burford@co.frederick.md.us
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Dan King, Senior Consulting Engineer, CSC, 410-691-6724, dking2@csc.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Dan King, 10/18/99

1   Purpose of Interview

Mr. Arch explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. Frederick County is a key "stake holder" in this process and as such was identified for interview.

2   Background

Frederick County has seen tremendous growth in recent years with the population increasing by 28% from 1990 to 1999. This population increase has impacted all county services from schools to roads but until the last year or so, schools have been the focus of attention. It is anticipated that over the next several years, with the population increase, traffic management will assume increasing importance.

At the present time there is some cost sharing with the State on transportation projects wherein State and County roads intersect. The County anticipates increased coordination with the State as its traffic problems become more complex and as a need develops to install more complex traffic management and ITS systems within the County.

3   Responsible Organizations

Within the Frederick County DPW, the Division of Transportation and Engineering is responsible for traffic signals at intersections between county-owned roads. Presently, two signals are maintained by the County. Having been primarily rural, there simply has not been a need to signalize county road intersections. The Division of Highway Operations within the DPW handles highway maintenance.

The Maryland State Highway Administration (SHA) is responsible for most of the other signals in the County, representing intersections of state-owned roads and intersections of state and county roads. Individual towns are responsible for the signals in their jurisdiction. There is dialog between the County and SHA, specifically in situations wherein State or Federal plans would impact County highways.

The Frederick County Planning Division is responsible for planning and zoning development within the County and as such works with the Division of Transportation and Engineering on the development of new projects that affect County thoroughfares. The Planning Division has done some traffic modeling using Washington Metropolitan Area Council of Governments (COG) models. However, because of the regional nature of these models, they have been of limited use to the County in the management of county highways. The Maryland Department of Transportation (MDOT) provided the models and system computer to the County.

Transit services within the County are handled by TransIT, a department under the County's Citizen Services Division. TransIT provides public transportation within the City and County, with a fixed route city bus service, county shuttle, MARC shuttle, paratransit, and commuter assistance services (car and van pool coordination). There are currently 33 vehicles in the fleet. Except for the MARC shuttles, TransIT has a limited need for coordination with neighboring jurisdictions with the exception of Montgomery County. Some Montgomery County RideOn system routes extend to points just inside the Frederick County line, most notably the Urbana Park and Ride. While existing TransIT routes do not extend far enough to connect with RideOn routes, such services are foreseen in the future as the County continues to grow.

The City of Frederick independently handles traffic and signal management within the City. For the most part, signals are not synchronized with the exception of those lights controlled by the SHA. At present, there is little requirement for interface between the County and City on signal or other traffic management issues.

4   Existing and Planned ITS Capabilities and Needs

Although there are currently no ITS systems within the County (other than the several signals), it is anticipated that there will be greater interest in ITS and in acquiring information from State owned ITS systems in the future, particularly along the I-270 and Rt. 355 corridor. It was suggested that information on weather conditions (for snow removal), long term traffic analyses, and in some cases incident management would all be of interest. At present, there is very little coordination with neighboring jurisdictions on these issues.

In addition to interest by the DPW in this information, it would be of even more immediate interest to the City of Frederick and Public Safety within the County. The City would be interested because of traffic incidents occurring on State and Interstate highways that have caused gridlock within the City on at least three occasions during the past year. Public Safety (State Police, Fire & Rescue, and the Sheriff's Department) would be interested because of increasing traffic congestion and associated accidents. Providing this information to these organizations is simplified by the fact that all are scheduled to move

into the same building in the near future and it might not be difficult to provide a feed from the State-wide CHART backbone network to that location.

5   Existing Telecommunications

In response to specific interview questions regarding existing telecommunications capabilities Ms. Courtney responded as summarized below.

5.1   Wireline

POTS is used for all inter-jurisdictional coordination.

5.2   Wireless

The county has an 800 MHz radio system with multiple channels for the use of the various county agencies. Channels are assigned for use by DPW, Animal Control, Public Safety (central alarm or 911), and TransIT. At present, none of the TransIT vehicles has a GPS/AVL locator system. An automated dispatch system is being considered that may involve a GIS but there is no money in the budget for this purpose.

5.3   Fiber

IIT, an authority board for County Government, manages a leased fiber backbone network for the County that includes 12 major hubs at locations in the City, some DPW facilities, and the site of the planned Public Safety Building (a joint facility for the Sheriff's Department, State Police, and Central Alarm). The fiber between nodes provides an OC-3 to OC-12 capacity depending on the leg. The backbone currently handles voice, data, and video (for the detention facility) on separate fibers and systems. The backbone fiber is owned by GS Communications Inc., the county's cable television franchisee.

The network is currently being transitioned to ATM over SONET to provide integrated voice, data, and video communications network. Lucent Technologies is the prime contractor for this effort with GS Communications as a subcontractor. ITT will own some of the fiber off of the nodes, as there are a few places where the county will have to lay a fiber to reach a facility. Some of the fiber has been designated for use by the City. To the best of Ms. Courtney's knowledge, there is no high-level topology drawing of the network but she will check and, if such exists, provide a point of contact to CSC to request it. She will also request a point of contact to obtain a listing of all node locations.

6   Actions Items

♦ Ms. Courtney to provide CSC with the names of contacts from whom to request fiber topology and node location information.

♦ CSC to coordinate the draft Interview Report with Mr. Hudak and Ms. Courtney to ensure the accuracy of the information contained therein.

Distribution

All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Department of Planning, Loudoun County Virginia
Date/Time:	December 6, 1999 – 10:30 AM to 11:30 AM
Location:	1 Harrison Street, 3rd Floor, Leesburg VA
Attendees	Sanjeev Malhotra, Loudoun County Department of Planning, 703-777-0246
	George R. Phillips, Loudoun County Department of Planning, 703-777-0246
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Ward Zerbe, Senior Consulting Engineer, CSC, 410-691-6713, wzerbe@csc.com
Prepared By:	Ward Zerbe, 12/10/99

1   Purpose of Interview

Mr. Arch explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. Loudoun County is a member jurisdiction of COG and as such was identified for interview.

2   Background

Loudoun County was recently identified as the third fastest growing county in the U.S.   With the tremendous increase in growth has also come the increase in transportation needs and projects. Route 15 has become the defacto outer beltway. While there has been heavy local opposition to widening this road, the County has a need to receive incident information from the surrounding jurisdictions that will help them manage traffic in the County. It is anticipated that over the next several years, with the population increase, traffic management will assume increasing importance.

3   Responsible Organizations

Within the Loudoun County government, the Department of Planning provides support for County transportation related issues such as transit and signal preemption.   The Virginia Department of Transportation (VDOT) provides all the road development, maintenance, and ITS functions for the County.

4   Existing and Planned ITS Capabilities and Needs

VDOT manages all signals in the County and is working to provide a terminal to Loudoun County for monitoring purposes. Signal preemption for fire and rescue purposes will be performed on a trial basis at Routes 7 and 641. This is a major intersection located in close proximity to Loudoun Hospital. Signal preemption has also been requested by the County at the intersection of Routes 15 and 662 and the

intersection of Routes 7 and 846 but has only been agreed to by VDOT at the 15 and 662 intersection in Lucketts.

Loudoun County has an interest in receiving information related to incidents on Interstates 495, 66 and 95.

5 Existing Telecommunications

In response to specific interview questions regarding existing telecommunications capabilities are as summarized below.

5.1 Wireline

No wireline telecommunications is in place given the lack of ITS in the County.

5.2 Wireless

As of one year ago, the county does not have an 800 MHz radio system.

5.3 Fiber

AT&T has fiber along Route 7 that comes from Fairfax County out as far as possibly the FAA Traffic Control Center just east of Leesburg. Fiber may have also been installed along the Greenway for ITS purposes.

6 Actions Items

♦ Follow up with Bob Griffin on the status of 800Mhz radio.

♦ CSC to coordinate the draft Interview Report with Mr. Phillips and Mr. Malhotra to ensure the accuracy of the information contained therein.

Distribution

All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Department of Public Works and Transportation (DPWT), Montgomery County Maryland
Date/Time:	October 18, 1999 - 9:30 AM to 11:00 AM
Location:	Montgomery County Traffic Management Center (MCTMC), 11th Floor, Montgomery County Executive Office Building
Attendees:	Bruce C. Mangum, Senior Engineer, Transportation Systems Management Section, 240-777-8778/8750, bmangum@dpwt.com
	Larry P. Keller, Program Director, ARINC, 410-266-4780
	Robert J. Force, Principal Engineer, 410-266-4711, rforce@arinc.com
	Mark S. Kapp, FiberNet Project Manager, ARINC, 301-251-0710, mkapp@arinc.com
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Dan King, Senior Consulting Engineer, CSC, 410-691-6724, dking2@csc.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Dan King, 10/18/99

1 Purpose of Interview

In support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information within the Region. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. The Montgomery County Department of Public Works and Transportation (DPWT) is a key "stake holder" in this process and as such was identified for interview. Mr. Mangum represented the DPWT during this interview.

2 Responsible Organizations

Within the County Government, there are two organizations that have a significant interest in ITS and the ITS infrastructure— DPWT and the Department of Information Systems and Telecommunications (DIST). This coordinated team approach is envisioned to continue over the next 2-3 years.

2.1 DPWT

The DPWT is responsible for developing and managing Montgomery County's Advanced Transportation Management System (ATMS). DPWT's mission statement for ATMS is to:

♦ Collect traffic information on all arterial roadways within the County (the State monitors Interstate Highways within the State).

♦ Use ATMS resources to verify and monitor incidents and to coordinate response activities to clear the roadway as quickly as possible.

♦ Make the roadway condition information so collected available to the Public

Originally the ATMS consisted solely of a traffic signal system that controlled some 750 signals throughout the county with second-by-second communications between each signal and a central computer. The only signals excluded from this system are those in the City of Rockville and a few in the recently annexed portion of Takoma Park. The Takoma park signals will eventually be incorporated. The City of Rockville retains responsibility for the signals within their jurisdiction. In time, this system designed by Eagle, Inc. was overlaid with an Orbital, Inc. designed ATMS that incorporated the signal system, other ITS collection devices (loops, CCTV, etc.), geographic information systems, and the County's transit system as an integrated whole. The Advanced Transit System (ATS) uses Automated Vehicle Location (AVL) services via the Global Positioning System (GPS) to monitor vehicle location and schedule adherence. Information collected in this system is displayed geographically on workstations at the MCTMC. No detailed descriptions are available on the Eagle or Orbital application systems.

Communications to the signals are carried over a 1200-baud, twisted-pair copper communications system. DPWT obtained permission from the appropriate parties to use existing utility poles to string this cabling throughout the county to reach the signals. As the ATMS continued to grow and include other ITS devices in addition to signals, DPWT began examining fiber optic technology to provide its "backbone" network. Because DPWT already owned usage rights, it was logical and expedient to maximize the use of the existing aerial rights of way to implement the fiber optic backbone network. In large measure, the new fiber optic cabling was simply strapped to the existing copper cable plant.

Concurrent with this work, the County became interested in the development of a fiber optic backbone network for other purposes and for use by other departments of the County Government. It seemed logical to expand the work already initiated by DPWT to incorporate all county needs. Hence, while the DPWT remains responsible for the physical installation and maintenance of the fiber optic backbone network, the design and integration of the network became the responsibility of DIST.

2.2 DIST

DIST is responsible for the design and implementation of all voice, video, and data systems within the County Government including telecommunications support to the ATMS. To this end, DIST contracted with ARINC for the design and integration of a fiber optic backbone network, building on initial DPWT efforts. This network is called FiberNet. Mark Kapp, the ARINC Project Manager, and Larry Keller, the Program Director, attended this interview. The point of contact within DIST is Dennis Rooney, Chief of Telecommunications, 240-777-2990. Any contact with ARINC personnel should be made through Dennis Rooney.

3 Existing and Planned ITS Capabilities and Needs

An overall description of Montgomery County's ATMS system is found on the DPWT Internet site, http://www.dpwt.com, and that description need not be repeated here. Existing ATMS components consist of subsystems for traffic signals, incident management, traffic information, and transit management. Much of the information collected by these systems is available on the Website and in the future will be made available at kiosks being installed by the County as well. Bruce Mangum described these systems during the interview and made the following remarks in elaboration:

♦ The traffic signal system consists of 750 +/- signals. The signal system detectors are now capable of collecting traffic count data. DPWT shares this data with the Maryland National Capital Park and Planning Commission (MNCPPC).

♦ Eighty-five CCTV cameras have been deployed along County arterials for use in verifying incidents and traffic operations. Two hundred are planned. Diamond Electronics is the vendor.

- ◆ CCTV camera images are shown on the County's Cable system (Channel 55) during the AM and PM peak commuting periods, M-F. Images are supplemented with real-time TAR audio. DPWT also operates Channel 55 during emergency events (e.g., major snowstorm).

- ◆ Travel advisory radio, at 12 sites, is currently restricted to the I-270 and Route 29 corridors. At present there are no plans to supplement these system with Variable Message Signs (VMS).

- ◆ The ATS currently polls each vehicle for location (and other information) every 90 seconds using one of three FM channels available to the transit system. The eventual goal is to link this information with signal synchronization within the framework of the overall ATMS. Of 200+ buses in the transit system, 100 have GPS transponders installed.

- ◆ Public Safety is currently migrating to a trunked, 800 MHz system, for use by their vehicles and DPWT will eventually do the same. This will free up the aforementioned FM channel for other use by Transit.

- ◆ Interface with neighboring jurisdictions is primarily by telephone. An exception is two T-1 lines that connect the Transportation Management Center (TMC) to SHA's Statewide Operations Center (SOC) for the exchange of information. One T1 is used for exchange of information (primarily video) between SOC and the MCTMC. The other T1 forwards video from SHA cameras to the Washington area media interface at the TMC (see next point).

- ◆ The MCTMC hosts a media interface to distribute roadway video views to the local news stations (Washington,DC TV stations 4,5,7, and 9). Video from the Montgomery County CCTV cameras and the SHA camera video forwarded from the SOC are made available for public viewing through this interface.

- ◆ The I-95 Corridor Coalition is monitored via an Information Exchange Network (IEN) station located in the TMC but it has not been particularly useful.

- ◆ The County does not provide ITS support to Commercial Vehicle Operations.

When asked what he would most like to see come out of this telecommunications study, Mr. Mangum suggested information that would facilitate the following:

- ◆ The linking of all local ITS management centers.

- ◆ Synchronized signal prioritization with the District of Columbia.

- ◆ Linking with VDOT for CCTV and incident information.

- ◆ Signal synchronization and future CCTV camera images with Prince George's County.

- ◆ The coordination of transit information with the Washington Metropolitan Transit Authority (WMATA).

- ◆ Replacement of T-1 lines to the MSHA SOC with fiber optic cable.

4   Existing Telecommunications

In response to specific interview questions regarding existing telecommunications capabilities Mr. Mangum responded as summarized below.

4.1   Wireline

POTS is used for inter-jurisdictional coordination. T-1 is used for video to and from the MSHA. DS3 will be used for the FiberNet backbone. ISDN, X.25, T-3 and SMDS are not used in the network. Frame Relay is not used for any ITS applications. The network is basically ATM over SONET. Coax was used

for the cable TV system but is being replaced. Multidrop is employed in that eight traffic signals are carried on each copper twisted pair.

4.2   Wireless

SSR is being experimented with for transit signs at bus stops (for short hops up to 3 miles where fiber would be too expensive). Microwave is utilized as the link between the County aircraft and permanent and mobile ground sites up to 10 miles distance. A mobile GIS system is being tested for command and control access to the transit database. No cellular is used for ITS purposes.

4.3   Facilities

Video will be made available at some maintenance sites and at the County Emergency Operations Center, which is located across the street from the TMC. Future plans also call for it to be made available to mobile police and fire command centers. DPWT is also considering co-locating with the County Emergency Operations Center.

5   Future Telecommunications Infrastructure

While additional detail will be required, FiberNet was generally described as an OC-3, 155 mbps network utilizing a meshed trunk backbone. There will be eleven hub sites connected via the meshed main trunk. Extending out from the hubs are feeders. From these feeders, individual connections (called drops) reach out to each entity on the network. Connectivity on the meshed trunk is via a 24-strand multi-fiber cable. Four strands are designated for use with the remaining 20 are reserved for future applications. The feeder lines will consist of 144 fibers. Fiber is being made available to users as it is installed. Bruce Mangun will provide a drawing showing the physical layout of the network. The network consists primarily of aerial segments with underground segments installed where necessary. ATMS is and will continue to be the primary user of the network for some time.

Once operational, the network will provide connectivity with the MSHA as Montgomery County will become a Traffic Operations Center (TOC) on the MSHA, CHART fiber optic network. Just as information collected by the SOC will be made available to Montgomery County, similarly information collected at the Montgomery County Operations Center will be made available to the State.

Initial planning was for the State and Montgomery County networks to connect at the Beltway but current planning is for the nets to connect near the Montgomery County signal shop located near I-270 and Seven Locks Road.

6   Actions Items

◆ CSC/PBFI to provide Bruce Mangum with a draft of the interview report for his comments/corrections as required.

◆ CSC/PBFI to Contact Dennis Rooney, DIST, to request additional detail on the capacity, devices, protocols, and topology of FiberNet.

◆ Bruce Mangum to provide CSC/PBFI with a drawing showing the physical layout of FiberNet.

Distribution

All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Metropolitan Washington Airport Authority (MWAA)
Date/Time:	November 15, 1999 - 1:30 PM to 3:30 PM
Location:	Reagan National Airport, 1 Aviation Drive, MWAA Offices
Attendees:	Louise Epps, MWAA, 703-417-8605, eppsl@mwaa.com
	Alex Ralli, MWAA, 703-417-8191, rallia@mwaa.com
	David McGrigg, MWAA, 703-417-8760, mcgriggd@mwaa.com
	Randy Hiller, Bell Atlantic, 703-417-8307, hillerr@mwaa.com
	Jack Reynolds, MWAA (MA 620), 540-890-7837, reynolds03@aol.com
	Beverly Massey, MWAA (MA 620), 703-417-8763, masseyb@mwaa.com
	Issa Khozeimeh, MWAA (MA 223), 703-572-2833, khozeimehi@mwaa.com
	Rowland Anderson, PBFI, 301-816-2762, randerson@pbworld.com
	Jeffrey P. Arch, PBFI, 301-816-1859, arch@pbworld.com
	Darrell Shahin, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Jeff Arch, 11/16/99

1   Purpose of Interview

In support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information within the Region.   To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. The Metropolitan Washington Airport Authority (MWAA) is a key "stake holder" in this process and as such was identified for interview.

2   Responsible Organizations

Established in the late 1980's, the Metropolitan Washington Airport Authority (MWAA) operates, maintains, and oversees Capital Construction Program (CCP) and Capital Maintenance & Investment Program projects for the Reagan National and Dulles International Airport facilities. Within MWAA, a Telecommunications Subcommittee comprised of planning, contractor, consultant, utility, and systems integration personnel consider the various telecommunications needs and commitments at each airport. The Subcommittee also coordinates their efforts with the Airlines Technical Committee, a committee comprised of airline representatives, who identify their own telecommunications needs. Recommendations are forwarded to the MWAA Executive Committee for their approval and subsequent action.

MWAA is in a rehabilitation phase at Reagan National Airport. A large Capital Improvement Project that resulted in the construction of a new terminal and the renovation of the old terminal is nearing

completion. Currently, the airport serves approximately 15,500,000 passengers a year. The Master Plan forecasts the airport to ultimately accommodate approximately 19,000,000 passengers a year. If Congressional legislation is passed that affects the "slot" rule, these passenger numbers will be adjusted accordingly. National Airport serves/is served by domestic flights. Conversely, MWAA is in a growth phase at Dulles International Airport. New roadways, parking facilities, concourse improvements, and other airside and landside development are planned in accordance to the Master Plan. The airport is ultimately planned to support an anticipated 55,00,000 passengers a year.

3   Existing and Planned ITS Capabilities and Needs

3.1   Airport Systems

A CCTV system monitors traffic and security conditions at the arrival and entrance platforms, access roads, and remote parking lots throughout both airports. Both analog and digital video is utilized; however, MWAA is migrating towards the use of digital video. The ultimate plan is to distribute video images via ATM technology. The video is not distributed to the Internet or other local and regional public transportation agencies. Airport police will respond to an incident if one has been detected and verified.

Optical Character Recognition (OCR) technology is being tested at Reagan National Airport in the daily A1 surface parking lot for automatic calculation of parking fees. The tests have been considered successful and it is anticipated this technology will be deployed throughout the other surface lots and garages A-C by December 2000. The use of Smart Card technology for parking fee payment is being tested at Dulles airport. Smart Card technology that is compatible with the, OCR parking fee system, Dulles Toll Road and WMATA Smart Cards is also under review. There is no deployment timetable, although the Smart Card technology will be implemented at Dulles International Airport. OCR and Smart Card technology are envisioned to be implemented together at both airports one day. OCR will provide the motorist with an electronic payment ticket and the Smart Card technology will provide the motorist the payment mechanism.

In Summer 2000, MWAA will be advertising a contract to revamp their flight arrival and flight departure information. The current amount of information currently displayed at one time will be enhanced and expanded.

3.2   Roadway Systems

MWAA owns the Dulles Access Road. A roadway weather information system is in place along the toll road. Mr. Issa Khozeimeh will provide the name of the vendor. (SCAN: 1-800-325-7226) MWAA future plans for the potential use of CCTV cameras along the Dulles Toll Road are unknown at this time; however, MWAA would be interested in having VDOT CCTV camera images provided to them along the Dulles Access Road, if deployed.

A highway advisory radio system operating at the 530 AM dial setting is at Reagan National Airport.

4   Existing Telecommunications

4.1   Wireline
Both the Reagan National and Dulles International Airport facilities have an extensive, intelligent infrastructure in place. Roughly 3,200 fiber optic strands have been deployed at Reagan National and roughly 5,000 fiber optic strands have been deployed at Dulles International. Each airport campus has a dual ring backbone running SONET OC-3. Connectivity between the airports is via OC-3, STS-1 services leased from Bell Atlantic. An AT&T DDM 2000 is located at each airport, functioning as the

interface for the leased services and main campus network hub. The fiber plant at each airport is approximately 10% single mode and 90% multi-mode. A fair amount of the fiber at both airports is "unlit".

MWAA shares and exchanges a large amount of data with many public agencies including various local/national law enforcement divisions. The Subcommittee suggested CSC/PBFI contact Craig Spence and Ed Cox (703-572-2730) at Dulles International Airport and Mark Balde and Warren Reecks (703-417-8050) to determine if MWAA has existing communications infrastructure connecting both Airports with local and regional public transportation agencies. The Subcommittee expressed an interest in traffic and transit data / information for use in advising exiting airline passengers, including:
- Real-time regional traffic data
- CCTV camera images
- Real-time transit schedules

4.2   Wireless

An 800MHz trunk radio system is employed for radio communications between the two airports. Channels on this system are also assigned for communications to the maintenance vehicle fleets serving each airport. This system is also used for a communications link with Loudon County emergency service providers.

4.3   Facilities

Operations centers for police and Fire Dispatch are located on the properties of Reagan National and Dulles International Airports. A co-location study will commence in 2000 to examine the potential for combining both centers. The site of this centralized operations center would be Reagan National.

5   Future Telecommunications Infrastructure

MWAA is studying the feasibility of installing new fiber optic cable connecting both Airports along the Dulles Toll Road – I-66 path. Right-of-way is an issue in the Crystal City and Arlington areas. SONET, OC-48 technology is envisioned.

6   Actions Items

♦ Issa Khozeimeh to provide CSC/PBFI with the name of the roadway weather information system vendor

♦ CSC / PBFI to contact MWAA Operations staff at each airport to determine if MWAA has existing telecommunications infrastructure connections to local and regional public transportation agencies

♦ CSC / PBFI to forward DRAFT Interview Memorandum to Greg Wollard to his review and approval

Distribution - All Attendees

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Metropolitan Washington Council of Governments (COG)
Date/Time:	November 18, 1999 – 10 AM to 12 Noon
Location:	777 North Capitol Street, N.E., Suite 300, Washington, D.C. 20002-4239
Attendees	Andrew J. Meese, Principal Transportation Planner, Department of Transportation Planning, MWCOG, 202-962-3789, 202-962-3202(f), ameese@mwcog.org
	Bob Griffiths, Director – Technical Services, Department of Transportation Planning, MWCOG, 202-962-3280, 202-962-3202(f), reg@mwcog.org
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Dan King, Senior Consulting Engineer, CSC, 410-691-6724, dking2@csc.com
Prepared By:	Dan King, 11/23/99

1   Purpose of Interview

In support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. As a key "stake holder" in this process, COG was identified for interview.

2   Responsible Organizations

Mr. Meese described COG's role as a regional organization of Washington area local governments and its responsibilities for regional transportation planning. He was quick to point out, however, that as a regional body, COG had no direct control over any ITS assets. Rather, it was the beneficiary of data collected through the use of the ITS assets of its member jurisdictions.

COG currently has a full time staff of approximately 125. Of this number, 45 are involved in some aspect of transportation planning.

3   COG Systems and Telecommunications

COG currently has a single administrative LAN employing both NT and UNIX servers. COG is moving to a total NT environment. A single T-1 line supports both Internet access and email requirements.

COG maintains a GIS, access to which is provided by UNIX workstations running ArcInfo and ArcView software. The GIS links ITS data collected by local jurisdictions with specific locations or highway segments. There are also several regional planning models maintained by COG. These models operate as stand-alone systems. More information on the use of these models can be obtained from the COG website, http://www.mwcog.org/trans/models.html.

COG provides modeling support to the District of Columbia, Virginia, and Maryland and much of the money provided by these jurisdictions goes for that purpose. COG is working with D.C. in the development of a GIS system for its use; in Maryland the CHART project will provide a linkage to COG's GIS; and in Virginia there are on-again, off-again efforts to provide a linkage with COG's GIS.

COG also has developed and maintains a Regional Transportation Data Clearinghouse that will include traffic volumes and other data for highway links in the modeled region network. The Clearinghouse database is designed to be used with a desktop GIS such as ArcView. Within the next several weeks a prototype of the latest version of the Clearinghouse will be delivered to local jurisdictions. Currently, the Clearinghouse is distributed on a series of diskettes once a year. Mr. Meese provided documentation of the Clearinghouse that was recently distributed to COG committees.[1]

Among the GIS databases maintained by COG is a planning database providing a gross resolution of $\pm$ 200 feet. During the interview, there was discussion as to whether or not the telecommunications data being inventoried by this study could be included in that database for sharing with local jurisdictions. In order to ascertain whether or not this was feasible, Mr. Griffiths agreed to provide CSC with details of this particular database and the GIS application. Mr. Griffiths also agreed to provide CSC with a listing of other planning models and databases maintained by COG. Current CSC/PBFI planning is to include telecommunications assets inventoried during this study in a GIS maintained by PBFI in Baltimore, and it may well be that this GIS application is identical to that employed by COG.

4   COG Planning Issues

One of the issues raised by Mr. Griffiths was responsibility for the processing of raw ITS data as more and more data is collected and provided to COG for inclusion in its models. At present (in the hardcopy mode), much of the analysis of the raw data is performed by the providing jurisdiction before it reaches COG. If COG were provided this data real time (as is implied by this telecommunications study), it would not have the personnel or systems to process and analyze this volume of raw data. VDOT recently contracted with the University of Virginia to collect and process ITS data state-wide and this may suggest one approach to the problem. This issue must be addressed before the real-time sharing of data can become a reality.

Mr. Meese pointed out that before specific proposals for the regional sharing of data are considered, COG members wish to get their own "houses in order." Maryland and Virginia both have significant projects underway that will impact how this data might be shared. Further, in addition to this telecommunications study there are other studies underway that might have to be completed before specific sharing options can be discussed. Among these studies are the *NOVA ITS Regional Architecture, the Metropolitan Area Wide Regional Architecture,* and the *COG Feasibility Study and Implementation Plan for Utilizing Existing and Planned ITS Installations and Equipment as Resources for Transportation Systems Usage Data.*

Mr. Meese also expressed the importance he places on the sharing of video images of traffic conditions— both within the region and with the citizenry. He suggested that these images might be made available through COG's Commuter Connections organization and made available at Park & Ride lots within the region. He suggested that this telecommunications study should consider that issue.

5 Actions Items

♦ Mr. Griffiths will provide CSC with details of COG's GIS planning database (± 200') and associated GIS application as well as a listing of the planning models and databases maintained by COG.

Distribution

All Attendees

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[1] Draft Report, *Regional Transportation Data Clearinghouse Project Progress Report*, November 5, 1999, MWCOG and National Capital Region Transportation Planning Board.

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Department of Public Works and Transportation (DPW&T), Prince George's County Maryland
Date/Time:	November 8, 1999 – 9 AM to 11 AM
Location:	Prince George's County Department of Public Works and Transportation (DPW&T), 4th Floor, 9400 Peppercorn Place, Landover
Attendees	David L. Hall, Engineering Technician, Office of Transportation, DPW&T, 9400 Peppercorn Place, Suite 400, Landover, MD 20774, 301-883-5650, dlhall@co.pg.md.us
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
	Dan King, Senior Consulting Engineer, CSC, 410-691-6724, dking2@csc.com
Prepared By:	Dan King, 11/8/99

1   Purpose of Interview

Mr. Arch explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. Prince George's County is a key "stake holder" in this process and as such was identified for interview.

2   Responsible Organizations

The Prince George's County DPW&T provides the County's transportation system, its roads, bridges, and public transit services. The Department consists of four offices—the Office of Engineering, the Office of Highway Maintenance, the Office of Project Management, and the Office of Transportation. Today, the Office of Transportation includes two components—Transit and Traffic. Traffic is currently responsible for all Intelligent Transportation System (ITS) related services including the proposed Traffic Response and Information Partnership (TRIP) Center. In the future, as TRIP and other ITS initiatives become operational, the Traffic portion of the Office of Transportation will be subdivided into two elements—Traffic Engineering and Traffic Operations—with TRIP falling under Traffic Operations. The DPW&T is the only element of Prince George's County Government working with ITS.

Transit Operations also fall within the purview of the DPW&T. Transit includes bus and paratransit services within the County using both owned and leased vehicles. Mr. Hall was not familiar with transit services and suggested that Mr. Jim Razewski, the Division Chief, be contacted for detailed information.

The Information Technology Division (ITD) within the Office of Management and Budget is responsible for all information systems support within the County including that required to support ITS.

3 Existing ITS Capabilities and Needs

Current PG County ITS activities are a natural outgrowth of the County systems used to control and operate signals located at major intersections throughout the County. Until recently, the County's Closed Loop signal system included 100 of 139 signalized intersections which were controlled and operated using Traconex controllers and Traconex software. These signals could be operated and controlled from either the DPW&T Headquarters located at 9400 Peppercorn Place in Landover or from the Signal Maintenance facility located at 8400 D'arcy Road near I-495. The remainder are operated and controlled locally. Signals at intersections on State roads or at the intersection of State and County roads are operated exclusively by the State. Mr. Hall supplied a list of County maintained traffic signal locations and their signal type.

The Traconex Closed Loop signal system is being upgraded to a Naztec Closed Loop System that provides a similar capability but adds some additional functionality and a better reporting capability. All 139 intersections are scheduled to be upgraded by January 1, 2000. Using the new system, pavement temperature data (from probes installed in the roadway) and traffic counts will be collected at specified intervals, 7x24. The information will be saved in two databases—the temperature data is converted to a GIS database to generate a GIS image at specified intervals. With few exceptions, there has been no need for signal coordination with other local jurisdictions.

Once the TRIP Center becomes operational, this signal information as well as information from other ITS systems yet to be installed will be fully integrated within the TRIP center. The software to accomplish this has not yet been developed and the County has been given approval to use as much of the software being developed for Maryland's CHART system as possible.

At present, no CCTV cameras are owned or operated by the County although two are planned on County roads that border FEDEX Stadium. Consideration is also being given to using video detection systems to replace loop detectors throughout the County and for incident management. A test installation is planned. Using this approach, it would not be possible to move the cameras, but the fixed view may still be adequate for both detection and incident management purposes. No camera feeds are currently received from any other jurisdiction.

Five, portable Variable Message Signs (VMS) are currently in use by the County and three additional are being purchased. Two semi-stationary signs are also planned for purchase. There is no Traffic Advisory Radio (TAR) operated by the County. There are no ITS devices, other than those described above, operated by the County.

4 Planned ITS Capabilities

Looking to the future, Mr. Hall suggested that the following capabilities would be of interest:

♦ Systems to provide traffic information (incident and transit) to PG County residents both on a County website and on the County cable channel.

♦ Video feeds from Maryland's CHART, VDOT, and Montgomery County systems used for incident management nearby or within PG County.

- ♦ Traffic condition information along sections of SHA's FITM routes that could impact County roads in the event of a beltway closure.

- ♦ AVL systems in County snow removal vehicles and the display of this information on a GIS-based system in the TRIP Center.

The limiting factor for all of these capabilities will be the County's ability to provide sufficient funding.

5 Existing Telecommunications

The following paragraphs describe telecommunications systems that are in use by the County.

5.1 Wireline

Dialup modems are used to provide connectivity from all signals to the closed-loop signal control system. The CCTV cameras currently scheduled for installation will probably be operated over twisted pairs, but a higher capacity service may be necessary depending on the quality of the video desired.

5.2 Wireless

Radio systems are used for communications with DPW&T vehicles. The radio system has two bands, one for DPW&T and the other for transit and other purposes. VMS signs can be operated from either the Peppercorn Place or D'arcy Road facilities using the cellular phone system.

5.3 Fiber

Comcast Cable, Inc. is currently installing cable throughout the County and, as part of its agreement with the County, will provide some fiber to all major County buildings. The focal point for this work within the County is ITD, and a consultant has been hired to support ITD in its negotiations with Comcast. This work is only now in the pre-design phase and Mr. Hall is unaware of any drawings showing the topology of the proposed network.

Mr. Hall has been advised by a representative from ITD that the County currently owns single mode fiber that connects the Largo complex with County facilities in Upper Marlboro. The architecture consists of two legs (1 from each end point) that converge at and are hubbed together at the Central Communications Facility located near the intersection of Central Avenue and Jonquil Street. Within the Largo complex, a multi-mode fiber campus backbone runs along McCormick Drive to connect three County buildings (including the Peppercorn facility). When installed the intended use of the single mode fiber was for teleconferencing. No ITS applications are implemented using this fiber. Detail on this fiber can be obtained from ITD.

6 Actions Items

- ♦ Mr. Hall to provide CSC with a drawing showing the topology of the Comcast and County fiber networks if such a drawing can found.

Distribution

All Attendees

CSC

PB

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Prince William County Network Engineering Department
Date/Time:	November 4, 1999 10:00 AM to 11:00 AM
Location:	Interview conducted via teleconference
Participants:	Tom Griffith, Manager, Network Engineering Division, 703-792-4096, tgriffith@pwc.gov.org
	Ward Zerbe, Senior Consulting Engineer, CSC, 410-691-6713, wzerbe@csc.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Darrell Shahin, 01/04/99

1   Purpose of Interview

Mr. Zerbe explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBF has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. Prince William County is a "stake holder" in this process and as such was identified for interview.

Network Engineering was the only Prince William organization to participate in this interview. Consequently, no data was collected concerning the County's roadways, signal systems, and maintenance operations. Mr. Griffith, however was aware that some photo red light sites have been implemented in the County.

2   Existing Telecommunications
2.1   Fiber

The County has leased fibers from GTE that provide connectivity between major office sites and public facilities. At the time of the interview, the network was utilizing Multimedia Data Service (MMDS) to carry 10MB Ethernet LAN and voice traffic. The major County government complex is located at One County Complex Court in Woodbridge, Virginia, just off the Prince William Parkway.

In year 2000, the network protocol will be transitioned to ATM. GTE will service its high capacity trunks using ATT Cascade switches and edge equipment manufactured by Fore will be employed to adapt client traffic into the trunks.

Mr. Griffith reported that the County school system has their own fiber network leased form GTE . The fiber runs between nine of the County's high schools and frame relay circuits are employed to reach 60 additional site (offices and smaller schools). This network is hubbed at Independent Hill, located on Route 234 halfway between I-66 and I-95.

A-35

Mr. Griffith also reported that the City of Manassas has installed their own fiber optic network. To the best of his knowledge, city offices, schools, other public buildings, and the signal system will utilize this network.

2.2   Wireline

Other than the frame relay circuits employed by the school system network, wireline resources are not in use in support of ITS.

2.3   Wireless

The County has acquired a new 800 MHz radio system. Radio communications are being transitioned to this system.

3   Action Items

The following action item resulted from the interview:

♦   CSC/PBFI will provide Mr. Griffith with a draft of this interview report for review to ensure the accuracy of the information contained herein.

Distribution

All Participants

CSC

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Potomac and Rappahannock Transportation Commission (PRTC)
Date/Time:	November 15, 1999 - 11:00 AM to 12:30 PM
Attendees:	Eric Marx, Director of Planning, Potomac and Rappahannock Transit Commission, 703-583-7782
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Mike Harris, Senior Supervising Engineer, PBFI, 703-742-5759, harris@pbworld.com
Prepared By:	Jeff Arch, 11/17/99

1 Purpose of Interview

In support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information within the Region. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. The Potomac and Rappahannock Transportation Commission (PRTC) is a key "stake holder" in this process and as such was identified for interview. Mr. Marx represented the PRTC during this interview.

2 Responsible Organizations

PRTC operates local bus service throughout Prince William County, M-F, between 7:30 AM and 6:00 PM at roughly 45-60 minute headways. Operations may be extended to 6:00 AM – 10:30 PM in 2000. PRTC operates commuter bus service, M-F, during the AM and PM peak commuting periods at roughly 15-30 minute headways. A fleet of 56 commuter-style buses serves passengers destined primarily to the Washington / Arlington cores. Limited commuter bus service is provided to the Franconia and West Falls Church Metro stations. Bus routes, schedules, and destinations served are clearly documented on PRTC's website – www.omniride.com.

Bus maintenance is carried out at PRTC's facilities located at 14700 Potomac Mills Road in Springfield. PRTC recently contracted to obtain operations and maintenenace support from WMATA for their bus services.

3 Existing and Planned ITS Capabilities and Needs

3.1 Real-Time Route Deviation
The evaluation of an Operational Test that would provide real-time route deviation along local bus routes is on-going. Local buses are outfitted with AVL and GPS units to monitor the location and tracking of the bus. The AVL service is currently not in use. Buses are re-routed to pick up passengers who have made a reservation with as little as two hours notice. Once fully operational, bus drivers will confirm passenger

trip completions via a Mobile Data Terminal (MDT) and transmit to the central tracking system, located at PRTC's offices in Woodbridge. A completion date has not been identified at this time.

3.2 Other Systems

Significant service disruptions and schedule changes are provided to the Partners In Motion on a regular basis via list-serv e-mail. Future ITS plans are not fully defined, although PRTC has a keen interest in providing information to their customers. One potential opportunity would be a Travelers Advisory Telephone system, however such a system has not been fully studied or funded at this time.

PRTC does not participate in any regional or local bus signal priority systems and/or operational tests. PRTC would be interested in being able to participate and take advantage of such systems in the Washington and Arlington cores where traffic congestion can impact their commuter bus service operations.

When asked what he would most like to see come out of this telecommunications study, Mr. Marx suggested a communications infrastructure that could support:
- Regional teleconferencing
- Two-way communications that would allow all regional transit providers to communicate on one common network

4 Existing Telecommunications

4.1 Wireline

PRTC does not make use of wireline mediums to communicate with their bus fleet.

4.2 Wireless

Basic two-way radio systems are used to communicate with the bus fleet operators and dispatchers.

4.3 Facilities

PRTC has a new (less than 2-years old) multi-purpose facility located at 14700 Potomac Mills Road in Woodbridge. PRTC corporate offices, a large maintenance facility, and a 200-space park-n-ride lot are housed on this site. There are no direct wireline or wireless communications connections from this site to other sites in the area, including other public transportation agencies. The I-95 corridor has fiber along the interstate right-of-way. The PRTC facility is adjacent to the I-95 corridor.

5 Future Telecommunications Infrastructure

Other than wireless communications needed to support further deployment of the aforementioned Operational Test, none are currently being planned for by PRTC.

6 Actions Items

◆ CSC/PBFI to provide Eric Marx with a draft of the interview report for his comments/corrections as required.

Distribution - All Attendees

CSC   **PB**

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Virginia Department of Transportation (VDOT)
Date/Time:	October 26 - 9:00 AM to 12:00 PM
Location:	VDOT, 3975 Fair Ridge Drive, Fairfax, VA
Attendees:	Tzung-Wen (Amy) Tang, Supervisor, ITS Transportation Engineer Program, VDOT, 703-383-2240, amytang@vdot.state.va.us
	Ken Hutchins, VDOT, 703-383-2071, hutchins_kr@vdot.state.va.us
	Mark D. Hagan, VDOT, 703-383-2071, hagan_md@vdot.state.va.us
	Kenneth J. Earnest, Jr., Senior Transportation Engineer, Intelligent Transportation Systems, VDOT, 804-786-9743, earnest_kj@vdot.state.va.us
	Larry Camp, GIS Analyst/Programmer, VDOT, 703-383-2249, camp_le@vdot.state.va.us
	David R.Evans, Transportation Construction Project Engineer, VDOT, 703-383-2739, evans_dr@vdot.state.va.us
	Wayne B. Haines, VDOT/TC, 703-383-2737, haines_wb@vdot.state.va.us
	Matt Miller, Senior Project Manager, Construction Engineering Services, Dewberry & Davis, 703-849-0668, miller_gm@vdot.state.va.us
	Gottfried A. Kofi, VDOT, 703-383-2607, ashalleykofi@hotmail.com
	Jeffrey P. Arch, Senior Supervising Engineer, PBFI, 301-816-1859, arch@pbworld.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
	Dan King, Senior Consulting Engineer, CSC, 410-691-6724, dking2@csc.com
Prepared By:	Dan King, 10/26/99

1   Purpose of Interview

Mr. Arch explained that in support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. VDOT is a key "stake holder" in this process and as such was identified for interview.

Ms. Tang introduced the participants and suggested that the meeting focus on telecommunications assets rather than general ITS capabilities. She explained that the individuals participating in the meeting had responsibilities for specific projects involving telecommunications assets and that each would describe those assets. This approach was dictated in large measure because there is no single, high-level VDOT topology diagram showing all VDOT fiber in Northern Virginia (NOVA). The use of fiber is discussed in the July, 1999 *Smart Travel Program in the Virginia Department of Transportation Northern Virginia District.* Ms. Tang will provide a copy of that document to CSC/PBFI.

2   Fiber

Fiber assets can generally be described by their geographic location—inside and outside (as well as along) the beltway.

2.1   Inside the Beltway

The initial Traffic Management System (TMS) was implemented in the early 1980's, primarily within the beltway and consisted of coax cable. This includes 30 miles of coax along I-66 and I-395. There is fiber inside the beltway on I-66 and I-395 but it is only the backbone or connection fiber that links the control room in Arlington to a new 34 mile system being constructed on I-66 and I-95 outside the beltway. It is planned to replace this coax and its associated equipment in a project to be advertised in April 2000 and to tie this spur fiber into the new fiber backbone. As the system is expanded to include areas beyond the beltway, fiber rather than coax is employed. Once the older coax and associated equipment have been replaced with fiber, it will then be possible to operate older and newer portions of the system as an integrated whole. Software to manage the entire network has already been written and is in use.

Federick Harris, Inc. is doing an inventory of all devices inside the beltway and inputting the information into an Access database. Select features from that database are also being put into a GIS database. However, because these devices are being replaced as new fiber is installed, the inventory and GIS will only be useful for the next year or so until that project is complete. The features included in this database and in the GIS are described in Endnote[i]. There is currently no intent to include fiber outside the beltway into either database and it is yet to be decided if fiber inside the beltway will be included.

2.2   Outside the Beltway

Initially, the only fiber that VDOT owned was a small portion of multimode on I-495 from Springfield to the Woodrow Wilson Bridge. As previously mentioned, there is fiber inside the beltway on I-66 and I-395 but this is only the backbone or connection fiber that links the control room in Arlington to the new 34 mile fiber system being constructed along I-66 and I-95 outside the beltway.

The new system will extend along I-66 from I-495 to Route 234 and along I-95 from Route 636 to Quantico Creek. In time, fiber will also be extended along I-66 to Gainsville as the HOV lane is extended to that area. This entire fiber is single-mode and it is being placed in conduit—none is overhead. The new system will also include fiber to reach the Woodrow Wilson Bridge. No fiber is currently planned to extend to the Cabin John Bridge.

There is a separate video subsystem to monitor traffic approaching the Woodrow Wilson Bridge on the south side of the beltway. It is a full motion analog system using multimode fiber. There are a total of 9 cameras (5 in Virgina and 4 in Maryland). They extend from the I-395 interchange on the Virginia side into Maryland as far as the Indian Head Highway interchange. The cameras are homed to the Smart Travel Center (STC). Twelve strands of fiber extend out from the STC to reach the cameras. Six of these strands extend into Maryland via submarine cable across the Potomac River. Two strands on the Maryland side are not in use and represent a possible communications interface point between VDOT and Maryland State Highway Administration. A drawing showing this fiber is referenced in Endnote[ii]. There are also 2 cameras at the American Legion Bridge at Cabin John that are fed to the STC over leased T-1 lines.

VDOT is also installing fiber to bypass the Springfield interchange on I-95. A total of sixteen conduits will be installed and of those, ten will be made available for lease to others. The layout of the project is

shown in the drawing referenced by Endnote[iii]. A map showing the location of this fiber as well as several other key fiber links in the NOVA area was also provided and is referenced by Endnote[iv].

The new system uses single-mode fiber optic cable with Synchronous Optical Network (SONET) technology to achieve an OC-12 data rate. A more detailed description of the proposed system, the devices included, and the hardware environment is described in Endnote[v]. Most trunks consist of 48 fibers. For I-95 and I-66, details of the trunk lines, hubs, and connectivity to individual devices are shown in block diagrams described in Endnote[vi] and Endnote[vii] respectively. These diagrams do not indicate exact hub or device locations, but that information is shown on the original construction drawings available from VDOT/Richmond. More accurate location information will be provided on "as built" drawings being prepared for the projects.

The general flow of collected data is from individual devices, to the hubs (or nodes), and thence to the STC (formerly referred to as the Travel Management Center or TMC). A block diagram for the STC was also provided and is described in Endnote[viii]. Data and video are carried separately over the fiber. The video is serviced using analog video multiplexing equipment manufactured by iMPath.

3   Resource Sharing Projects

There are several resource-sharing projects in progress that involve fiber installation.

3.1   Dulles Access Road Spur

A 48-fiber cable is being installed from I-66 along the Dulles Access Road spur to Spring Hill Road. Some nine to eleven cameras will be placed along that route. This link ties the Dulles Toll Road to the remainder of the NOVA fiber net and the STC. The Dulles Toll Road itself has some 144 fibers along its length.

3.2   Route 234

A single conduit is being placed along Route 234 from I-66 in Manassas Park to I-95 in Dumfries. Once complete, this segment will provide a closed SONET ring for NOVA. Construction is being performed on a resource-sharing basis by the same firm that is putting fiber along the Dulles Access Road spur.

3.3   State-wide

The current terms of the Statewide Fiber Resource Sharing Agreement calls out the following for VDOT:

♦ An OC-12 SONET network fully installed, operated, and maintained by the private partner,

♦ Forty-eight (48) optical fibers in dedicated cable along urban Interstate segments (Metro DC, Hampton Roads, and Richmond);

♦ Eighteen (18) optical fibers in common sheath (same cable as private partner's) along all other Interstate segments.

Over the next several years, the intent is to implement resource sharing along interstate highways in NOVA, followed by projects in Hampton Roads and Richmond.

4   Traffic Signal Management

Of the some 1000 signals managed by VDOT in NOVA, approximately 800 are controlled using communications lines leased from Bell Atlantic. In general, fiber is provided between central office and key node locations and copper to the individual devices. These leases are scheduled to expire in 2004 and will be replaced by radio and fiber assets to be owned by the State. The signals are managed from a central location within VDOT facilities located at 3975 Fair Ridge Drive. While it is planned to provide connectivity from the STC to this location, there is no intent to integrate signal management with the overall management of ITS from the STC

5   Interfaces with Neighboring Jurisdictions

In general, there are none although some Federal money has been earmarked for the sharing of data with the Partners In Motion and the sharing of video images with local TV stations and Fairfax County.

6   Other Communications Links

Some spread spectrum is used for VMS along the Fairfax County Parkway, the Beltway near Gallows Road, the Springfield Interchange Project, and at several other locations. The frequencies are unlicensed and interference is a problem. All links go back to the STC. There is also some VMS on leased lines and dialup modems along Route 1, Prince William Parkway, Fairfax Parkway, and a few other locations. In all cases, these approaches were used at locations where it wasn't economical to run fiber.

Remote Communications Units (RCUs) are used inside the Beltway for gates, ramp metering, and some loops but are being phased out because they are unreliable. No use is made of ISDN.

7   Future Needs

While no specific information sharing needs were expressed in the meeting, the general requirement for data sharing was clearly described. According to Ms. Tang, VDOT is going to develop a Northern Virginia ITS Architecture early next year and that architecture will define specific information sharing needs. In addition, the Smart Traffic Center is intended to share information with Partners In Motion and Maryland's new CHART system. Smart Traffic will also share video images with emergency service providers (Fairfax County Police, State Police, etc.) through the Springfield Interchange incident management function, but the detail for doing so still needs to be defined.

STC will also share information with Smart Signal for incident management. Smart Signal will also need to share data with transit operating agencies to implement "signal prioritization". Last, but not least, Smart Signal will need to coordinate signal timing with neighboring jurisdictions (cities and towns in Northern Virginia and Arlington County that operate their own signal systems). Again, specific needs will be identified through the development of a Northern Virginia ITS Architecture.

During the meeting it was also suggested that WMATA might serve as a good backbone network for the sharing of information and that COG might serve as a repository for ITS data collected throughout the region. In this way, the data might be made available to all for analytical purposes.

8   Action Items

The following action items resulted from the meeting:

♦ Ken Earnest will provide Jeff Arch with contacts for obtaining more detailed information on the Frederick Harris work inside the Beltway as well as contacts for on-going work outside the Beltway.

♦ Mr. Kofi will provide a block diagram of the Woodrow Wilson fiber segment.

♦ Ms. Tang will provide CSC/PBFI with a copy of the draft *VDOT ITS Strategic Plan.*

♦ CSC/PBFI will provide Ms. Tang with copies of all technical information obtained from meeting participants to the extent that she does not already have that information.

Distribution

All Attendees

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[i] Exhibit 1: Proposed Data Tables and Fields, 8/9/98, provided by Larry Camp.

[ii] VDOT Cameras and Fiber in Maryland, provided by Gottfried Kofi

[iii] Proposed VDOT Bypass, Dwg. No. 1, LSI Lightwave Spectrum, Inc., dated 8/13/98, provided by Wayne Haines.

[iv] Undated map of key NOVA fiber links, provided by Wayne Haines.

[v] Software Design Document, VDOT Project 222-94A, pages 1-2 through 1-9, June 9, 1997, provided by Dave Evans.

[vi] VDOT 222-94A Virginia Fiber Ring Block Diagram I-95, Alcatel Contracting, Inc. Dwg. No. FR-VDOT-PROP-195, three sheets, last revised 16-93-98, provided by Dave Evans.

[vii] VDOT 222-94A Virginia Fiber Ring Block Diagram I-66, Alcatel Contracting, Inc. Dwg. No. FR-VDOT-PROP-166, three sheets, last revised 16-93-98, provided by Dave Evans.

[viii] VDOT 2222-94A Communication Block Diagram for TMC, Alcatel Contracting Dwg. No. COMM-BLK-TMS, one sheet, last revised 21/05/97, provided by Dave Evans.

CSC

PB
100 YEARS

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Maryland State Highway Administration (SHA)
Date/Time:	November 9, 1999
Location:	Statewide Operations Center (SOC), 7491 Connelley Dr., Hanover, MD 21076
Attendees:	Dale Lineweaver, CHART Application Administrator, 410-582-5695, dlinewea@sha.state.md.us
	Jerry McVey, CHART Network Administrator, 410-582-5690, jmcvey@sha.state.md.us
	Bobbie Sharma, Engineering Associate, PBFI, 301-984-6461, sharma@pbworld.com
	Ward Zerbe, Senior Consulting Engineer, CSC, 410-691-6713, wzerbe@csc.com
	Dan King, Senior Consulting Engineer, CSC, 410-691-6724, dking2@csc.com
	Darrell Shahin, Principal Engineer, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Darrell Shahin, 12/27/99

1   Purpose of Interview

Mr. Zerbe explained that in support of the Metropolitan Washington Council of Governments (MWCOG), the Maryland State Highway Administration (SHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information. To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for sharing of ITS information between local jurisdictions. This interview was held to identify SHA's own ITS resources as well as its initiatives, telecommunications assets, future plans, and needs.

CSC/PBFI has supported SHA's Coordinated Highway Action Response Team (CHART) program for several years, and therefore, is familiar with SHA's existing ITS systems and telecommunications assets. Consequently, this meeting concentrated on discussing future plans, desired improvements, and data sharing opportunities with other jurisdictions and agencies. An overview of the existing ITS and telecommunications is included in this report for completeness.

2   Responsible Organizations

SHA is one of five modal administrations that comprise the Maryland Department of Transportation. These agencies and their principal responsibilities are:

- SHA – Maintenance, management, and planning of highways, state roads, signal systems, and related ITS and communications systems.
- Mass Transit Administration – Commuter rail operations and Baltimore City public transit services.
- Maryland Aviation Administration – Operation of Baltimore-Washington International Airport.

- Maryland Port Administration – Operation of the Port of Baltimore
- Motor Vehicle Administration – Driver licensing and vehicle registration.

The Secretary of the Maryland Department of Transportation also oversees the Maryland Transportation Authority (MdTA). MdTA is responsible for the maintenance and management of toll facilities – bridges, tunnels, and roads (none of which are located in the MWCOG region).

Additionally, there are several parkways administered and maintained by the National Parks and Planning Commission in the Baltimore/Washington region that have developed into major commuting arteries.

3   Existing and Future ITS Capabilities

3.1   CHART

The principal vehicle SHA has used for the deployment of ITS systems is the CHART program. Many activities are currently in progress. CHART had its genesis with the "Reach the Beach" project in the mid-80's to improve travel to and from Maryland's Eastern Shore. It has evolved into a program for the deployment of video cameras, DMS, TAR, RWIS, and speed/lane occupancy detectors statewide. The majority of the devices and all the cameras are concentrated in the densely developed Baltimore-Washington corridor, extending eastward to Annapolis and westward to Frederick. This region is known as the Golden Trapezoid. CHART is scheduled for a 10-year build-out, with completion of Phase 1 scheduled for the end of 1999.

The program is directed by the CHART Board, consisting of senior technical and operational personnel from SHA, Maryland Transit Authority, Maryland State Police, Federal Highway Administration, the University of Maryland Advanced Transportation Technology and various local governments. The Chief Engineer of the SHA chairs the board.

CHART's significance also extends beyond its immediate transportation uses. CHART is likely to constitute a significant portion of Net.Work.Maryland, an initiative for the design and deployment of a State-wide high-speed fiber network.

3.1.1   Operations Centers

The CHART system is enhanced by a state-of-the-art command and control center called the Statewide Operations Center (SOC). The SOC acts as the hub of the CHART system, functioning 24 hours a day, seven days a week. There are additional satellite Traffic Operations Centers (TOCs) spread across the state to handle peak-period traffic. TOC3 and TOC4 manage traffic response activities for the Washington and Baltimore regions respectively. A seasonal TOC in Annapolis supports summer beach traffic and another in LaVale manages snow removal operations on I-68 through Western Maryland.

3.1.2   Video

There are currently 38 operational cameras, with approximately 10 more scheduled to come on-line shortly. Over 200 cameras will be deployed when the CHART build-out is finished. The cameras are manufactured by Cohu and employ NTSC analog video technology. Because fiber was not initially available to many camera sites, communications to most of them are via T1 circuits. Consequently, CHART utilizes video encoders to digitize and compress (384Kbps, 15-frame per second) the camera images for transmission over the T1 circuits. Up to 3 cameras can be serviced on a single T1 line.

A unique feature of CHART is that viewing and control of cameras is not limited to the SOC. CHART uses asynchronous transfer mode (ATM) technology for the control and distribution of video images at

multiple SHA facilities. A custom-developed user application called the ATM Video Control Manager (AVCM) enables users at each facility to select cameras for viewing, specify monitors, and control cameras. AVCM enforces a priority hierarchy based on defined user classes to grant privileges to view and control cameras and arbitrate simultaneous requests for a particular camera.

3.1.3 CHART Backbone

In conjunction with the AVCM video distribution system, an OC-3, ATM network was implemented to serve as the CHART backbone. Currently, the SOC, TOC3, District 3 HQ, Radio Shop, and District 4 HQ are connected to the backbone using resource share fiber (see Section 4.1). Other facilities (TOC4 and some shops) are reached via T1 circuits. In time, connectivity to this backbone will be extended to all of SHA's significant facilities (District HQs and shops).

Eventually, SHA's enterprise network and the CHART network will be merged. The original vision was to grow the CHART backbone into a unified backbone for all MDOT modal agencies. Other future plans for the CHART backbone are now in transition due to the advent of the Net.Work.Maryland initiative for a high-speed, high-capacity statewide network which is likely, in time, to subsume CHART.

3.1.4 Roadway Systems

Under CHART, DMS, TAR, RWIS, and speed/lane occupancy detectors have been and continue to be installed statewide. Communications to these devices are centralized to the SOC, however, the DMSes are currently being transitioned to a decentralized architecture as part of the CHART II effort. Data obtained from the radar detectors is fed into TraView, an application that dynamically displays traffic conditions on a map of the state's major highways. The SOC subscribes to the SCAN weather service to supplement data from the RWISes to monitor weather conditions across the state.

Traffic counting is conducted by the new products group out of SHA HQ at 707 Calvert Street. There are currently 90 sites statewide. The group is actively looking for opportunities to share the traffic count data with other organizations.

3.1.5 Web Site

CHART hosts a web site for dissemination of traveler information to the public. A visitor to the site can view live video from the cameras, observe the TraView roadway conditions map, obtain weather reports from SCAN, and view the most recently reported data from the RWISes.

3.2 CHART II

The initial design of the CHART system was centralized to the SOC. Following the lead of the AVCM, the goal of the CHART II initiative is a decentralized application that supports access to field devices from multiple SHA facilities. The first phase is being implemented for the DMSs. The CHART II application will employ an integrated user interface for accessing and controlling CHART ITS devices. In time, AVCM will eventually be incorporated into the CHART II user interface.

Related to CHART II, SHA has a long-term goal of transitioning to NTCIP-compliant field devices. In the interim, there will be issues with legacy devices that won't be replaced until their useful life spans are achieved. A realistic timeframe to reach full NTCIP compliance is 10-15 years.

3.3 Signal Systems

The Office of Traffic is responsible for SHA-controlled signals. Of some 4600 signals in the state, approximately 2000 are SHA's responsibility. The deployment strategy to date has been to "put the smarts on the road" and let the signal controllers do their work. Systems manufactured by Econolite are utilized. Each on-street master controller can control up to 24 signaled intersections connected via twisted pair copper wiring. There are 700+ POTS lines for remote management of the signal controllers. The controllers have-call back capabilities when certain threshold conditions occur.

The current signals use in-pavement sensors for vehicle detection. The Office of Traffic is looking at the new Econolite Autoscope technology that uses cameras for vehicle detection. Discussions also have started about the possible integration of the signal control system into CHART.

3.4 Other Systems

The Office of Maintenance investigates new devices, particularly those that can assist winter storm management activities. They have recently installed an automated bridge sprayer test site in Western Maryland. It automatically sprays snow/ice melting chemicals on the roadway based on readings it receives from a nearby RWIS. The maintenance and snow removal fleets currently are not equipped with AVL. The Office of Maintenance is interested in AVL, subject to the availability of funding.

4 Telecommunications

4.1 Fiber

Through a resource share agreement with MCI, SHA/MDOT has 48-fiber optic strands that run down I-83 from the Pennsylvania border to I-695, around the west side of I-695, then down I-95 to I-495, where it terminates in a communications hub facility in College Park. This fiber is being utilized to build the CHART network backbone. Five SHA facilities are currently connected via this fiber: District 4 HQ, Radio Shop, SOC, TOC3, and District 3 HQ. Communications over this fiber are ATM over OC-3 SONET.

Significant additional fiber will become available in conjunction with the Net.Work.Maryland effort. Resource share fibers will be obtained from Level 3 Communications along I-68 from the west, to I-70, down I-270, then along I-495 to a communications hub in McLean, Virginia. Another leg will leave this hub, go through the District of Columbia, and enter Maryland along the US-50 corridor to I-97. From here it will head up I-97, to I-695, to I-95, and will extend to the Delaware border along I-95. A third leg will come up US-301 from the Nice Bridge in southern Maryland, connecting with the leg along US-50 west of Annapolis. Communications over this fiber are expected to be ATM over OC-192 SONET. In the long term, the CHART backbone will eventually be integrated into Net.Work.Maryland.

4.2 Wireline

SHA uses many different wireline services to communicate with facilities and devices across the state. T1's for camera sites and CHART backbone connectivity have already been mentioned. SHA's enterprise backbone makes extensive use of frame relay with ISDN backup, particularly outside of the densely developed center of the state. There are numerous POTS lines to the DMS, TAR, detector, and RWIS devices. ISDN is being phased in for the DMSs as part of CHART II. Leased ATM services may also be employed to reach future hub sites on the CHART backbone.

4.3 Wireless

SHA maintains a statewide radio system. The Radio Shop, located at the west-side intersection of I-695 and US-40, is the main maintenance and laboratory/test bed facility. Communications to the maintenance fleet is via the radio system. Maintenance vehicles are not equipped with AVL.

5 Interfaces with Neighboring Jurisdictions and Other Agencies

SHA is a strong proponent of sharing ITS video and data with neighboring jurisdictions, other State/ MDOT agencies, and the public. SHA welcomes inquiries from organizations desiring connectivity to the CHART network.

5.1 Existing Interfaces

The following data sharing interfaces are either in place or in progress:

- Baltimore and Washington media feeds to provide camera images for broadcast on regional television stations.

- Video interchange between the SOC and the Montgomery County Traffic Management Center.

- CHART network connections to Maryland State Police (MSP) Barracks Q (College Park) and R (Essex). Extension of connectivity for viewing road side cameras to all MSP facilities serving the Golden Trapezoid region is planned.

- CHART network connection to MdTA's Authority Operations Center (AOC).

- CHART network connection to the Maryland Emergency Management Agency operations center.

- Weather data sharing with Harford County. In exchange for access to data from county-owned weather sensors, SHA provides a dedicated line for access to SHA's web site.

- Public access web site previously discussed.

- Participating member of the I-95 Coalition.

5.2 Future Opportunities and Desires

During the interview, Mr. Lineweaver indicated the following desires for improved data sharing:

- The ability to see the whole Capital Beltway and other major highways leading into and out of the State. SHA would like to know what is on the other side at the transition points.

- Improved I-95 Coalition coordination.

- SHA and VDOT have agreed in principal to sharing information between the SOC and VDOT's Smart Travel Center. Mr. Lineweaver stated he would like to see these discussions start moving toward identifying and planning the necessary physical connections.

- Evolution of the SOC into a multimodal operations center and information clearing house for all modals. This has been a concept for the future of the SOC since it was built, but at this point in time it must be considered a long-term vision.

- A common protocol for the exchange of information both within and without CHART.

6 Action Items

The following action items resulted from the meeting:

♦ CSC/PBFI will provide Mr. Lineweaver with a copy of this report to review for accuracy prior to finalization.

Distribution

All Attendees

CSC

PB

MEMORANDUM OF INTERVIEW

Subject:	Telecommunications Study, Interview with Washington Metropolitan Area transit Authority (WMATA)
Date/Time:	October 29, 1999 - 1:00 PM to 3:00 PM
Location:	WMATA Offices, Washington, DC
Attendees:	Rick Stevens, WMATA, Office of Business Planning, 202-962-1257, rstevens@wmata.com
	Craig Maxey, WMATA, Office of Systems, 202-962-1526, cmaxey@wmata.com
	Jeffrey P. Arch, PBFI, 301-816-1859, arch@pbworld.com
	Darrell Shahin, CSC, 410-691-6714, dshahin@csc.com
Prepared By:	Jeff Arch, 11/11/99

1   Purpose of Interview

In support of the Metropolitan Washington Council of Governments (COG), the Maryland State Highway Administration (MSHA) is sponsoring a telecommunications study in the Washington Metropolitan Area (WMA) to support the exchange of Intelligent Transportation Systems (ITS) information within the Region.   To that end, CSC/PBFI has been tasked with conducting an inventory of existing telecommunications assets and, based on an analysis of those assets, identifying opportunities for a more effective exchange of ITS information between local jurisdictions. The Washington Metropolitan Area Transit Authority (WMATA) is a key "stake holder" in this process and as such was identified for interview.

2   Responsible Organizations

Various Offices within WMATA are actively involved in the planning, development and deployment of Intelligent Transportation Systems (ITS). The Office of Business Planning is responsible for the organizations ITS planning efforts. The Office of Systems is responsible for prioritizing and overseeing the implementation of ITS. The Office of Systems has also been tasked to ensure that WMATA's overall ITS program is consistent with overall WMATA organizational needs. Beyond WMATA, the metropolitan Washington region looks to WMATA for transit ITS guidance.

3   Existing and Planned ITS Capabilities and Needs

3.1   Bus Transit Systems

Currently, 250 buses are equipped with a GPS system provided by CleverDevice. These buses also have next stop annunciation capability. No Automatic Vehicle Location (AVL) devices or tracking is currently done for WMATA buses, and as such, no real-time bus transit schedule information is available. Static bus transit schedule information is available on WMATA's website. An extensive AVL deployment that outfits the entire WMATA bus fleet is anticipated once the deployment of a new digital trunked radio system is completed. (The AVL system will operate over this radio communications medium).

When asked what types of ITS and information WMATA may be interested in sharing / receiving from other MWCOG agencies, Messrs. Stevens and Maxey suggested:

- A common, regional bus signal priority system

- Fare integration – new fare boxes that are capable of handling cash and smart card transactions

- A common regional communications system for the regions bus providers – WMATA, Montgomery County Ride-On, Prince George's County The Bus, Alexandria DASH, Fairfax County Connector, City of Fairfax CUE, and PRTC's OmniRide to improve regional bus services.

- The ability to expand transit traveler information dissemination, i.e., Dulles Airport Cable Channel, etc.

- Roadway weather information system data for use in routing buses

3.2 Rail Transit Systems

A dynamic rail transit display system informs passengers of the next destination and time of arrival for the next train. Information is displayed on the platforms. Deployment is on-going, with full deployment anticipated by the end of 2000, although real-time information may not be immediately available.

4 Existing Telecommunications

4.1 Wireline
Fiber optic and copper cable are the current predominant wireline communications medium used for the rail transit systems. Leased T-1 lines are occasionally utilized to connect outlying areas of the rail transit system.

4.2 Wireless
A limited amount of microwave communications are used to connect outlying rail transit facilities. The microwave communications is used to connect these facilities with the existing fiber optic cable system. Basic, two-way radio communications are provided between the WMATA bus fleet and the Operations Center.

4.3 Facilities

An Operations Center is housed in the basement of the WMATA offices located at 600 Fifth Street, NW in downtown Washington. Real-time train operations are continuously monitored from this facility. It is unlikely that the Operations Center will relocate within the next 3-5 years. The Operations Center is not hardwired or connected to any outside agency transportation facilities.

5 Future Telecommunications Infrastructure
WMATA is in the process of identifying their future fiber optic cable needs for the next 5-10 years. The study is anticipated to be completed in early 2000. While the study can be categorized as "work in progress", is expected, among many things, to:
- Examine current fiber optic cable capacity and identify how to make the best use of it. Existing fiber optic cable is used for trackside rail transit communications.
- Identify the need to replace existing rail transit copper communications with fiber optic cable
- Identify a set number of cables be set aside for regional sharing purposes with undefined uses

As the study is anticipated to include a number of sensitive data and information, WMATA prefers not to make a Draft copy of the study available for use on the DC Area Telecommunications Study. It was agreed that CSC/PBFI would follow-up with WMATA in the future to obtain input in the development of potential short-term and long-term opportunities that would facilitate information exchange.

A new digital trunked radio system (490 MHz) will be deployed in the early 21st century. Specifications have been developed and WMATA is moving towards procuring the new system. The system will replace the current radio communications system used by the bus fleet to communicate with the operations Center staff.

6   Actions Items

♦   CSC / PBFI to forward DRAFT Interview Memorandum to Rick Stevens and Craig Maxey for review and approval

♦   CSC/PBFI to follow-up with WMATA to obtain input in the development of potential short-term and long-term opportunities that would facilitate information exchange

Distribution - All Attendees