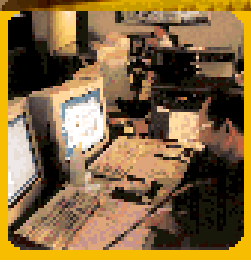
Institutional Coordination of ITS in the Delaware Valley

Delaware Valley
Regional Planning
Commission

November 2000



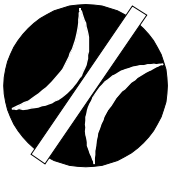
INSTITUTIONAL COORDINATION OF INTELLIGENT TRANSPORTATION SYSTEMS (ITS) IN THE DELAWARE VALLEY

COORDINATION WHITE PAPER

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
The Bourse Building
111 South Independence Mall East
Philadelphia, PA 19106

November 2000

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency that provides continuing, comprehensive and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia, in Pennsylvania; and Burlington, Camden, Gloucester and Mercer counties in New Jersey. DVRPC provides technical assistance and services; conducts high priority studies that respond to the requests and demands of member state and local governments; fosters cooperation among various constituents to forge a consensus on diverse regional issues; determines and meets the needs of the private sector; and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the Commission.



Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole, while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The preparation of this document was funded by grants from the Federal Highway Administration and the Pennsylvania Department of Transportation. The authors, however, are solely responsible for its findings and conclusions, which may not represent the official views or policies of the funding agencies.

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I. INTRODUCTION

The deployment of Intelligent Transportation Systems (ITS) throughout the Delaware Valley is occurring at various rates by different organizations. Most organizations are proceeding independently with little or no coordination with neighboring agencies and Information collected by these high-tech systems is shared on a piecemeal and fragmented basis among the region's agencies. Although there are a few informal relationships to exchange information, there is no long term regional plan or framework to share the information collected on the region's transportation network. In addition, there are no provisions to undertake a multi-agency approach to the management of traffic or incidents. DVRPC has been working with many of the ITS stakeholders through the Delaware Valley ITS Coordinating Council (Appendix A) and the Delaware Valley ITS Technical Task Force (TTF) (Appendix B) to develop a framework for institutional coordination. This document will present a set of recommendations for implementing a Philadelphia Regional Integrated Multi-modal Information Sharing (PRIMIS) concept which was developed in cooperation with the Technical Task Force to provide the region's ITS stakeholders opportunities to share and disseminate information on travel conditions and coordinate the regional deployment of ITS systems in the Delaware Valley.

Models of regional ITS coordination from other areas of the country were examined with regard for how they could potentially be implemented in this region. Four separate scenarios along with the region's existing approach were presented to the Technical Task Force for their input. To identify the scenarios for further discussion, names were assigned based on the approach of the particular scenario: Existing, Cooperative, Decentralized, Centralized and Regional Operations Center. The Technical Task Force reviewed each of these scenarios and felt that none of them were entirely appropriate for this region. However, there were elements of several scenarios that the TTF liked, they suggested a concept that was a hybrid of those scenarios and adapted it to this region. This sixth scenario was identified as Interactive Database. Among the other benefits potentially derived from this scenario, the TTF's intent was to provide a communications backbone for the exchange of information among organizations and to promote institutional coordination.

On behalf of the TTF, DVRPC staff presented this concept along with the other scenarios to the Delaware Valley ITS Coordinating Council. The Coordinating Council had some concerns about how the Interactive Database scenario would address the following issues: 1) regional traffic management - would this scenario create a mechanism to oversee the coordination of the regional

exchange of information and manage the appropriate agencies response when an incident occurs; 2) after hours coverage - would this scenario enable facilities to be monitored, information to be exchanged, and incident responses to be carried out on a 24 hour a day, 7day a week (24 x 7) basis; and 3) travel information to customers - would this scenario provide timely information about the travel conditions on the region's transportation system to its customers.

In order for PennDOT Central Office to make an informed decision on the appropriate scenario for institutional coordination, they requested that DVRPC provide a more detailed description of each of these scenarios including information on how the institutional coordination would be structured, how agencies would coordinate their operations, how facilities would be monitored after hours, how the scenario would be implemented, the staffing implications, and the approximate costs. The next section of this document provides that detailed information for each of the six scenarios.

The stakeholders have been arranged into 3 tiers (Appendix C) based on their roles in providing transportation services in the region, the scope of the facilities they operate and their ability to implement intelligent transportation systems. DVRPC conducted in-depth interviews of all ten Tier I organizations to determine their decision making processes during incidents, their procedures for monitoring and responding to incidents, and their internal and external information flows. This information allowed DVRPC to analyze the six scenarios as they relate to the operational needs of the region's key ITS stakeholders. That analysis along with a discussion of each agency's after hours coverage is presented in Section III. After hours operations refers to those procedures and activities used by operating agencies to monitor their facilities and provide the services necessary to respond to incidents that occur during the overnight or weekend time periods.

The last section of the document presents a set of recommendations for institutional coordination and regional information sharing as they were developed through a coordinated effort by DVRPC with significant input from the Coordinating Council and Technical Task Force. The recommendations are presented in a three-phase approach identified as Philadelphia Regional Integrated Multi-modal Information Sharing (PRIMIS). The staging, staffing, costs and implementation steps are presented for each phase.

II. COORDINATION SCENARIOS

OVERVIEW

This section of the document examines several models of regional ITS coordination which are being used in other metropolitan areas of the country and presents how they could potentially be applied in this region. The six scenarios: Existing, Cooperative, Decentralized, Centralized, Regional Operations Center and Interactive Database, are presented individually. To explain how these scenarios could be adapted to serve this region, the following nine characteristics are examined for each scenario:

Institutional Structure

- Describes the relationships (formal/informal) among the participating stakeholders.

Information Sharing Among Organizations

- Describes how information on travel conditions would be shared by the stakeholders.
- Identifies the type of information to be shared and which organizations might be involved.

Operations Coordination

- Describes operational procedures that would be set up among stakeholders to coordinate activities for traffic or incident management.

Information Sharing to the Public

- Describes how information on travel conditions would be disseminated by the stakeholders to the public.
- Identifies the type of information to be disseminated and the technology that would potentially be used.

After Hours Coverage

- Describes the procedures the stakeholders would have in place to monitor their facilities and provide the services necessary to respond to incidents that occur during the overnight and weekend time periods.
- Identifies whether stakeholders would have their own staff on duty during these time periods or if partnerships could be worked out among stakeholders to share responsibilities for after hour coverage.

ITS Planning

- Identifies who would be responsible for planning for regional ITS deployment, developing a regional ITS vision and capital plan and insuring consistency with the regional ITS architecture.

Scenario Implementation

- Describes the steps that would need to be taken by the stakeholders to implement the scenario.
- Identifies the committees and/or subcommittees responsible to undertake these steps.

Scenario Staffing

- Identifies the staffing requirements for the participating stakeholders.

Scenario Costs

- Identifies rough order of magnitude costs required to complete activities such as: planning, administration, training, hardware and software acquisition, communication linkages, system maintenance and staffing.

EXISTING SCENARIO

This scenario represents a continuation of the activities currently being undertaken to implement Intelligent Transportation Systems in the Delaware Valley. Although there are some attempts at coordination and information sharing among the stakeholders (e.g. Delaware Valley Highway Operations Group - DVHOGs), it is fragmented and there is no formal structure or a coordinated long range plan. Promulgation of this scenario will not lead to a multi-agency approach to the management of traffic or incidents.

Institutional Structure

No formal institutional relationship will be developed in this scenario. Several loosely formed voluntary groups (Coordinating Council, Technical Task Force, DVHOGs) would continue to meet on a periodic basis to exchange information on their individual plans for implementing ITS components within the region. These forums would continue to be hosted by DVRPC which would be responsible for developing meeting agendas and other administrative tasks required to bring the appropriate stakeholders together. These groups would not have a formal chairman, not be led by elected officers and would not be empowered to take formal action on regional initiatives.

Coordinating Council - This voluntary policy level group would be jointly facilitated by PennDOT and DVRPC, or alternatively NJ DOT and DVRPC. The Coordinating Council is envisioned as a multi-modal, tri-state task force composed of the key decision makers from Pennsylvania, New Jersey and Delaware who are charged with developing and implementing transportation policies for their organizations. The primary role of the Council would be to provide guidance on regional

ITS policy among the stakeholders and provide a vision on the deployment of ITS activities in the region. It is assumed only one meeting will be held each year or when the Technical Task Force feels some policy level guidance is required. Typically, attendance at the meetings would vary contingent upon the topic predicating the meeting. DVRPC would provide staff support that includes hosting the meeting, developing the agenda with the chairpersons, mailing out reminders, making telephone calls to confirm attendance and taking and distributing meeting minutes.

Technical Task Force (TTF) - Initially, this voluntary group would convene at monthly meetings and provide an opportunity to foster interagency coordination at the technical level through official agenda topics and informal networking. The group would be comprised of the ITS stakeholders in the Delaware Valley representing a mixture of the operators of the region's primary transportation facilities, other public organizations involved in transportation, organizations responsible for incident response, funding agencies and others as deemed appropriate. Meeting topics may include periodic agency updates, recommendations for the Region's Transportation Improvement Program (TIP)/12-Year Program funding, providing a forum for outside vendors such as Traffic.com to address the ITS community, discussions on joint/regional responses to federal initiatives, input into the development and refinement of the Regional ITS Architecture and topics of current interest. Once the Regional ITS Architecture development is completed, quarterly meetings may be more appropriate. DVRPC would provide the staff support for this group.

Delaware Valley Highway Operations Group (DVHOGs) - In addition to the forums currently hosted by DVRPC, a few of the region's stakeholders are partners in the I-95 Corridor Coalition. The Coalition is a regional partnership of transportation agencies within the 12-state Northeast region bringing its members together to address ITS solutions to shared transportation problems and challenges. The DVHOGs represents a subset of the 12-state region and brings together traffic operations center personnel and law enforcement officers from the Delaware Valley at bi-monthly meetings to improve coordinated incident management.

Information Sharing Among Organizations

This scenario would not provide any substantial changes to the current procedures used by the region's agencies to share information on travel conditions. There is currently no widespread, formal process set up to share information among the region's ITS stakeholders. The I-95 Corridor Coalition's Information Exchange Network (IEN) is available to some of the region's agencies. However, many of those who have access to it, do not consider it to be their primary

method of information dissemination.

Some organizations have developed relationships with other organizations to provide specific information such as major incident conditions or video feed. Examples of this type of cooperation include, 1) PennDOT District 6-0 Traffic Control Center (TCC) which supplies live video feeds from their I-95 closed circuit TV (CCTV) cameras to the Philadelphia Police Radio Room and the fax notification system members of the DVHOGs use to inform other operating agencies that there is an incident on their facility. A listing of those organizations included in this fax service can be found in Appendix D. Much of the sharing of information that now occurs is an outgrowth of informal working relationships among operations personnel and not from formal policy level decisions to integrate operations with other organizations.

The existing information sharing process is fragmented, lacking a regional vision or commitment to work together. The common model for information sharing is on a one to one basis not a "many to one" (TRANSCOM) or "many to many" model. This scenario envisions no changes to the existing information sharing process.

Operations Coordination

Within this scenario, no formal regional process would be set up to coordinate operations on the region's transportation facilities among the ITS stakeholders. Limited arrangements may occur between individual organizations such as NJ DOT and the NJ State Police, where an officer of the State Police is located in NJ DOT's Traffic Operations Center to coordinate the State Police incident response with NJ DOT's incident response activities.

Operations coordination among the region's ITS stakeholders occurs on an incident by incident, or on an as requested basis. After initial notification, an assessment is made to evaluate the scope (e.g. road closure, hazmat spill), location and anticipated duration of the incident. An operating agency may then call another operating agency to lend or request resources or personnel. Although no formal regional agreements or memoranda of understanding exist, this coordination has evolved through previous experiences and is fostered by periodic meetings of the DVHOGs.

Information Sharing to the Public

Currently there is no regional, comprehensive source of real-time travel information available for public access. Many of the stakeholders have developed their own processes for disseminating

travel or incident information to the public. The most common method is to notify the traffic reporting services when an incident has occurred. Through partnerships with television and radio stations, this information is then broadcast to the public. The amount of air-time available and the broadcasting delay often leads to incomplete, sketchy or outdated information. Some organizations have deployed variable message signs and/or highway advisory radio to disseminate information to the traveling public while en-route. SmartRoute Systems, through partnerships with PennDOT and NJ DOT, provides real time incident information over the Internet, or via a telephone (land line and cell phone) call-up system for a limited network of routes. Several agencies offer travel advisories on their websites which provide information about on-going construction projects on their facilities but gives no real-time operating condition information. As is the case with sharing travel information among the region's stakeholders, the existing procedures to disseminate travel information to the public is a fragmented process lacking a regional vision or commitment to work together.

After Hours Coverage

This scenario envisions no changes to the existing procedures which the organizations have in place to provide coverage of their facilities during the overnight or weekend time periods. Transportation facilities in this region are generally monitored through either an agency's control/operations center or through the radio room of the police force that patrols the facility. Typically, the operations centers are staffed on a weekday basis with coverage beginning just prior to the morning peak period and ending just after the evening peak period. The centers are not typically staffed during the overnight or weekend time periods. However, these agencies have procedures in place which would notify personnel of an incident and initiate the appropriate response. In this region, the after-hours coverage function of incident detection and notification is typically performed by the police who operate 24 hours a day, seven days a week. Although they do have some type of after hours notification procedures in place, PennDOT District 6 and NJ DOT are the only stakeholders in the region that do not provide after hours coverage either through their control center or through a police force. After hours calls to NJ DOT's traffic operation center in Mt. Laurel get rerouted to the NJ DOT Central Dispatch Unit in West Trenton and NJ DOT Incident Management Response Team (IMRT) staff is notified at home if appropriate. In the case of PennDOT , after hours calls concerning incidents are rerouted to TRANSCOM in northern New Jersey and to the local traffic reporting services. These groups can then page PennDOT Traffic Control Center staff at home if it is deemed necessary.

ITS Planning

Planning for the deployment of ITS technologies or ITS programs will continue to be the responsibility of the individual agencies under this scenario. Each operating agency would have its own long range plan or vision for ITS deployment and would consider them in the development of their capital plans. The existing scenario does not provide for any procedures to develop a coordinated, regional ITS vision or capital plan. Individual agencies may request federal funding for ITS deployment through DVRPC's TIP. That agency would be required to certify that the expenditure of federal funds for ITS deployment would be consistent with the Regional ITS Architecture Requirements. The Technical Task Force may endorse projects which request use of TIP funding.

Scenario Implementation

To implement this scenario, the Technical Task Force would review its membership rolls to determine if there are any other organizations that should be invited to participate. The TTF would set up specific subcommittees to provide guidance on specific challenges or opportunities (information sharing, funding requests, regional initiatives, private sector participation etc.). The TTF would develop a preliminary meeting schedule for a given fiscal year. The Coordinating Council would approve TTF recommendations and provide policy guidance. Staff support to the TTF and Coordinating Council would be provided by DVRPC and will need to be placed on DVRPC's annual work program.

Scenario Staffing

This scenario would not require the individual stakeholders to hire any additional staff. Staff support to the Coordinating Council, TTF and subcommittees would be provided by DVRPC. DVRPC would establish agendas (based on discussions with the agencies), send out meeting notices, write meeting minutes, coordinate meeting follow-up activities and provide meeting space. This could be accomplished with existing DVRPC staff.

Scenario Costs

This scenario would not require any direct cost to the individual stakeholders other than meeting participation. The cost for DVRPC to coordinate and host this regional ITS forum would be approximately $100,000 per year.

COOPERATIVE SCENARIO

This scenario is primarily based on the previously described existing scenario although it continues to build upon it by establishing formal DVRPC ITS committees to foster the coordination and information sharing among the various stakeholders. Currently there are some attempts at coordination and information sharing among the stakeholders, it is fragmented and there is no formal structure or a coordinated long range plan. However, under this scenario, a regional ITS strategy for information sharing will be formulated. ITS priorities and project development will also be addressed

Institutional Structure

Formal ITS Committees would be established within DVRPC's committee structure. To give the ITS committees formal recognition, both the Coordinating Council and the Technical Task Force would become standing committees under DVRPC's aegises. This would be similar to DVRPC's Delaware Valley Goods Movement Task Force and the Regional Aviation Committee. This step would integrate the committees with DVRPC's planning and funding functions.

Coordinating Council - This policy level group would be jointly chaired by PennDOT and DVRPC, or alternatively NJ DOT and DVRPC. The Coordinating Council is envisioned as a multi-modal, tri-state task force composed of the region's key decision makers who are charged with developing and implementing transportation policies for their organizations. The primary role of the Council would be to provide guidance on regional ITS policy among the stakeholders and provide a vision on the deployment of ITS activities in the region. The Coordinating Council will meet on a semi-annual basis. DVRPC would provide staff support that includes holding the meeting, developing the agenda, mailing out reminders, making telephone calls to confirm attendance and taking and distributing meeting minutes.

Technical Task Force - This group provides an opportunity to foster interagency coordination at the technical or operational level. The TTF membership represents the primary operators/planners of transportation facilities and services in the Delaware Valley region. These include members of Tier I organizations, such as the state DOT's, public transit agencies, toll authorities, state and Philadelphia police/fire departments. While many Tier II organizations already participate, a concerted effort would also be made to obtain additional involvement from other Tier II organizations, including 911 operators, traffic reporting services, county/municipal representatives,

municipal police/fire departments, transportation management associations and others as deemed appropriate.

The primary objective of the TTF is to encourage interagency coordination. Other responsibilities would include developing and updating the regional ITS vision and recommending ITS projects for the TIP and 12-Year Program funding, maintaining the ITS Regional Architecture and adhering to National ITS architecture consistency requirements. The TTF may sponsor training courses/outreach programs, provide periodic agency updates, provide a forum for outside vendors (such as Traffic.com) to address the ITS community, host discussions on joint/regional responses to federal initiatives and give input into the development and refinement of the Regional ITS Architecture and topics of current interest.

Meetings would be held on a monthly basis with additional meetings for any subcommittees formed to guide regional initiatives such as information sharing and incident management. DVRPC would provide the same staff support as they do to the Coordinating Council.

Delaware Valley Highway Operations Group (DVHOGs) - In addition to the forums currently hosted by DVRPC, a few of the region's stakeholders are partners in the I-95 Corridor Coalition. The Coalition is a regional partnership of transportation agencies within the 12-state Northeast region bringing its members together to address ITS solutions to shared transportation problems and challenges. The DVHOGs represents a subset of the 12-state region and brings together traffic operations center personnel and law enforcement officers from the Delaware Valley at bi-monthly meetings to improve coordinated incident management.

Other Subcommittees - Other subcommittees may need to be formed on an as needed basis to respond to other activities that arise such as coordinated regional initiatives.

Information Sharing Among Organizations

This scenario would attempt to make modest changes to the current procedures by complimenting current activities with additional outreach programs to enhance the ability of the region's agencies to share information on travel conditions.

Currently, agencies deal with each other on a point to point basis, where an agency deals with only one other agency at a time. Some organizations have developed relationships with other

organizations to provide specific information such as major incident conditions or video feeds. One example of this type of relationship includes, PennDOT District 6-0 Traffic Control Center suppling live video feeds from their I-95 CCTV cameras to the Philadelphia Police Radio Room.

The members of the DVHOGs use a fax notification system to inform other operating agencies that they are experiencing an incident on their facility. Much of the sharing of information that has occurred has been an outgrowth of informal working relationships among operations personnel and not from formal policy level decisions to integrate operations with other organizations.

DVRPC has interviewed all ten of the organizations that fall under Tier I in order to determine their decision making process during incidents, their notification process and to document the flow of information internally and externally between agencies. The purpose of these interviews was to assess the agencies' ability to communicate with other organizations and the public as well as to explore opportunities for new partnerships that could enhance day to day operations. A technical memorandum will be developed that will allow agencies to see how other agencies operate. This will give them a better perspective or insight on how other agencies operate and allow them to foster new relationships or partnerships by determining what information or resources each agency has that may be beneficial to others. To gain an even broader picture of how the region functions, DVRPC would expand the interview process to include most of the organizations that are within in Tier II .
This scenario applies a proactive approach to improving the information flow between agencies. Any missing linkages between agencies will be identified and this will help to develop better mechanisms or procedures to enhance the communication framework. The list of contact names and numbers that the DVRPC has collected will be expanded to incorporate the information ascertained during the agency interviews. The end result will be the implementation of new "low-tech" approaches to improve communication. The development of additional information and contacts would also benefit the notification of DVHOGs and allow them to expand their interagency cooperation.

The TTF would also be involved in creating an outreach program where they would sponsor workshops, agency tours and training classes. These workshops would be aimed at both the planning and operating agency personnel to obtain a better understanding of the data received from other organizations, discuss mutual problems of data collection, and disseminate sensitive data. Based on the workshop topic and the target audience, several sessions may be held to account for the various shift hours.

Operations Coordination

Currently operations coordination among the region's ITS stakeholders occurs on an incident by incident, or on an as requested basis. Although no formal regional agreements or memoranda of understanding exist, this coordination has evolved through previous experiences and is fostered by periodic meetings of the DVHOGs. This scenario begins to develop more structured procedures to coordinate operations on the region's transportation facilities among the ITS stakeholders.

As part of TTF outreach program, workshops will be held where the relevant agencies would discuss their internal procedures/criteria for posting variable message sign/highway advisory radio (VMS/HAR) messages, and any protocols that would allow another agency to request changes to or add additional information to a VMS/HAR. A by-product of these workshop would be to construct maps with VMS/HAR locations, procedure manual for contacting other organizations, and regional diversion routes with appropriate signing and traffic control.

Information Sharing to the Public

As with the Existing Scenario this scenario provides no regional, comprehensive source of real-time travel information available for public access. Again, many of the stakeholders have developed their own processes for disseminating travel or incident information to the public. The most common method is to notify the traffic reporting service who in turn notify both the television and radio stations that an incident has occurred. Some organizations have deployed variable message signs and/or highway advisory radio to disseminate information to the traveling public while en-route. SmartRoute Systems, through a partnerships with PennDOT and NJ DOT provides real time incident information over the Internet, or via a telephone (land line and cell phone) call-up system on a limited network of routes. Individual agencies may also offer travel advisories on their web sites to provide information about on-going construction projects on their facilities but gives no real-time operating condition information.

As is the case with sharing travel information among the region's stakeholders, the dissemination of travel information to the public is a fragmented process lacking a regional vision or commitment to work together. However, this scenario does attempt to coordinate with additional Tier II agencies, such as traffic reporting services or transportation management associations and the end result may help to build new relationships that enhance the information dissemination process. Because of the enhanced coordination effort, limited public/private partnerships may result.

After Hours Coverage

The Cooperative Scenario envisions no changes to the existing procedures which the organizations have in place to provide coverage of their facilities after hours.

ITS Planning

Although planning for the deployment of ITS technologies or ITS programs will continue to be the responsibility of the individual agencies under this scenario, this Cooperative Scenario authorizes the TTF to act as a forum for regional ITS Planning. The TTF would report to the Coordinating Council, who would then make formal recommendations to the DVRPC Board. TTF responsibilities include developing a regional ITS mission statement, setting ITS priorities and making recommendations of ITS projects for the TIP and 12-year program funding. The TTF would also serve as the custodian for the ITS Regional Architecture making sure that local projects adhere to ITS architecture consistency requirements. The TTF encourages interagency coordination by sponsoring training courses and outreach programs aimed at assisting the stakeholders with the Regional ITS Architecture and maintaining National ITS consistency requirements when deploying their ITS technologies or programs.

Scenario Implementation

In order to implement this strategy, the DVRPC Board would have to formally establish the ITS Coordinating Council, Technical Task Force and give the TTF the authority to establish specific subcommittees that provide guidance on specific challenges or opportunities (information sharing, funding requests, regional initiatives, private sector participation etc.). The Coordinating Council would approve TTF recommendations and provide policy guidance. The TTF would review the current membership and invite other appropriate organizations to participate. Both the Coordinating Council and Technical Task Force would have to elect a chair and establish meeting schedules at the beginning of each year. Each organization would designate a formal representative and alternates for each committee and subcommittees. Both committees may expand membership and invite observers to attend contingent upon the topic predicating the meeting. Staff support to the TTF and Coordinating Council and for planning activities, such as updates to the Regional ITS Architecture and outreach programs, would be provided by DVRPC and would need to be placed on DVRPC's annual work program.

Scenario Staffing

This scenario would not require the individual stakeholders to hire any additional staff. Staff

support to the Coordinating Council, TTF and subcommittees would be provided by existing DVRPC staff in the same manner as the Existing Scenario. These tasks would also include the responsibility of maintaining any updates to the Regional ITS Architecture and coordinating the outreach programs.

Scenario Costs

This scenario would not require any direct cost to the individual stakeholders other than meeting participation. The cost for DVRPC to coordinate and host this regional ITS forum and maintain the regional architecture would be approximately $400,000 per year.

DECENTRALIZED SCENARIO

This scenario represents a concept that utilizes and focuses the I-95 Corridor Coalition's Information Exchange Network. The purpose of this scenario is to facilitate communications including information sharing and limited operations coordination among regional stakeholders. The information will be used to support coordinated transportation management through a component of the I-95 IEN that is more focused on the Delaware Valley. Physically, the IEN would consist of workstations located at operations/control centers or other designated stakeholder sites. The workstations could be connected to one another via the I-95 Corridor Coalition's Wide Area Network (WAN). Each agency would provide local information via their workstation. The workstations transport agency data via the communications network to a regional server(s) where it is combined with data from other agencies. The regional server(s) then distribute(s) the regional/corridor information to each agency for display on their IEN workstation. During the planning and implementation of this scenario, coordination is necessary between the I-95 Corridor Coalition and the DVHOGs.

Institutional Structure

To integrate regional ITS planning with DVRPC's planning and funding functions, this scenario would establish the Coordinating Council and Technical Task Force as standing committees of DVRPC. Because this scenario would utilize a version of the I-95 Corridor Coalition's IEN, it is envisioned that a formal Memorandum of Understanding (MOU), signed by the participants, would be required to focus the IEN on this region. The MOU would identify the additional transportation facilities to be added to the system which would create a finer grained network for this region. It

would also establish an Information Sharing/Operations subcommittee of the Technical Task Force with bylaws, outline decision making responsibilities within the group, assign funding commitments to the individual participants and assign a lead agency to contract services for regional cooperative initiatives. The contracting agency would need to coordinate with procedures established by the I-95 Corridor Coalition.

Coordinating Council - The Coordinating Council's primary role under this scenario will be the same as in the Existing Scenario. DVRPC would provide staff support.

Technical Task Force - In addition to tasks described under the previous scenario, the TTF's functions would include: overseeing the development and implementation of the regional component of the I-95 IEN. Initially, bi-monthly meetings are envisioned possibly transitioning to quarterly with subcommittees formed to deal with specific regional initiatives. There would be a concerted effort to obtain Tier III (counties, media, TMAs, municipal police and fire, etc.) organization involvement. DVRPC would also provide the staff support to this group.

Information Sharing/Operations (IS/O) Subcommittee - Due to the data sharing requirements of this scenario, an MOU would establish a subcommittee of the TTF to develop a local component of the IEN using Coalition standards. This subcommittee will be responsible for identifying transportation facilities and data elements to be added to the system, conducting compliance reviews, developing budgets and overseeing maintenance contracts. Since this will entail purchasing new equipment and modifying operating procedures to integrate into existing systems, the members of this subcommittee should be familiar with their organizations' equipment and operations. In order to design an effective system, the MOU should contain commitments from participating organizations including the I-95 Corridor Coalition.

I-95 Corridor Coalition - The Coalition is a regional partnership of transportation agencies within the 12-state Northeast region. Its members work together to address ITS solutions to shared transportation problems and challenges. Any modifications to the IEN to make it more focused on the Delaware Valley, such as adding facilities into the network, increasing the number of stakeholders who have access to workstations, etc., would need to be approved by and coordinated with the Coalition.

Delaware Valley Highway Operations Group (DVHOGs) - In addition to the forums currently hosted by DVRPC, a few of the region's stakeholders are partners in the I-95 Corridor Coalition

and participate in it's Delaware Valley Highway Operations Group. The DVHOGs represents a subset of the 12-state region and brings together traffic operations center personnel and law enforcement officers from the Delaware Valley at bi-monthly meetings to improve coordinated incident management.

Other Subcommittees - Other subcommittees may need to be formed on an as needed basis to respond to other activities that arise such as coordinated regional initiatives.

Information Sharing Among Organizations

The long-term objective of this scenario is to establish a computer message/digital message system to notify agencies about incidents or unusual conditions that affect them. It would be based on a modified version of the I-95 Corridor Coalition's IEN with an increased number of transportation facilities in the Delaware Valley and improved accessability by additional organizations. Supplemental technology may also be used to support the IEN in field to center or center to home communications (beepers, cellular phones). The ultimate intent of this scenario is to include as many Tier I and Tier II organizations in the IEN as possible.

Using the interview information, the IS/O Subcommittee will help to expand the IEN and address implementation and operational problems which arise. The IS/O Subcommittee will develop procedures which outline when specific agencies should be notified based on the location, duration and severity of an incident, what type of information is shared through the IEN and how frequently the data should be updated. A communications consultant will assist the IS/O Subcommittee in the development of a database for participants which would allow them to integrate their existing operations into the IEN. This consultant would also assist in the development of additional mapping required to display transportation facilities added to the system. The consultant would also provide workshops to train the agencies' operations personnel, obtain a better understanding of data needs of other organizations, and discuss mutual problems of obtaining information. Differing personnel shift hours would be accommodated.

Operations Coordination

As part of the IS/O Subcommittee activities, agencies will present internal procedures for posting VMS/HAR messages and procedures to request use of that equipment by other agencies. A procedure manual would be produced which would indicate the appropriate methods for contacting each organization and the resources, including manpower, that each organization would be willing

to share in the event of an incident. The manual would also include maps of each agency's VMS, HAR and CCTV locations. Recent discussions among the DVHOGs concerning regional incident diversion plans and regional video sharing should be addressed and evaluated to determine if these are applicable activities which can be added to the IEN.

Information Sharing to the Public

Workshops will be held for ITS organizations and Information Service Provider (ISP)/media to explain the data collection process, availability of information to these groups (free, per use basis, by subscription) and how the media can better utilize this information. Workshops will be held every 1-2 years. Individual agencies would still be responsible for disseminating travel information to the public. Access to the IEN will not be available to the general public.

After Hours Coverage

This scenario partially addresses the issue of after hours coverage for those agencies without a 24 hour a day, seven day per week (24 x 7) operations center by allowing limited operations control by other agencies. Access to information on the IEN would be available to stakeholders 24 x 7. Each stakeholder would determine their own IEN workstation staffing hours and develop procedures for their personnel to access the network if their workstation is not staffed 24 x 7. Those stakeholders which operate their workstation 24 x 7 may assist in notifying the staff (by cell phone or beeper) of those stakeholders which do not when an after hours incident has occurred which impacts their facilities. Since those operating agencies can not respond to incidents if their staff is not immediately available, limited operations control (initiate VMS/HAR messages) by another designated agency may take place until staff from the affected agency is in place. Those agencies without after hours coverage may still be afforded limited incident detection through local police patrols.

ITS Planning

Planning for the deployment of ITS technologies or ITS programs will continue to be the responsibility of the individual agencies under this scenario. The TTF, as in other scenarios, would serve as the custodian for the ITS Regional Architecture and make sure that local projects adhere to National ITS architecture consistency requirements. The TTF would also encourage interagency coordination by sponsoring training courses and outreach programs aimed to assist the stakeholders with the Regional ITS Architecture and maintain National ITS consistency requirements when deploying their ITS technologies or programs.

Scenario Implementation

The DVRPC Board would formally establish the ITS Coordinating Council, ITS Technical Task Force and the provide authority to establish subcommittees such as the Information Sharing/Operations Subcommittee. The Coordinating Council would sign a formal Memorandum of Understanding (MOU) to indicate their commitment for planning and funding. The Coordinating Council would need to sign an MOU with the I-95 Corridor Coalition which would permit modifications to the existing IEN and spell out the procedures for doing so. The TTF would develop annual ITS planning activities or projects that can be incorporated into the DVRPC work program or TIP. The TTF would prepare responses to federal grant opportunities and sponsor outreach/training courses and conferences.

The IS/O Subcommittee, along with a hired consultant, would develop a database for the new IEN and procedures (with a manual) for the operations of the network. A formal agreement should be developed indicating the participating organizations willingness to cooperate with the procedures. A consultant should be retained to maintain the system. The IS/O Subcommittee and consultant would develop cost allocations for each stakeholder's participation. Once the IS/O Subcommittee and consultant have developed the database for the new IEN and the procedures for it's operations, the coordination and operations should migrate to the DVHOGs.

The Coordinating Council should designate a lead agency for issuance of consultant/vender contracts. Funding should be placed on the TIP for consultant services. The Coordinating Council should also develop an annual budget and have it adopted by the DVRPC Board.

Scenario Staffing

Coordinating Council/Technical Task Force - The participation on the Coordinating Council or Technical Task Force would require no direct costs or additional staff to the stakeholders. Existing DVRPC staff will serve these committees.

Information Sharing/Operations Subcommittee - Meeting participation and training may require significant staff time by the stakeholders. Some agency operating procedures may have to be modified and some of their staff may have to carry beepers or cellular phones to receive messages. Additional staff may need to be hired by the participants to operate the IEN, especially if the agency decides to expand their hours of operation. Information Sharing/Operations Subcommittee staff support (provide meeting space, notices, meeting minutes), hire consultant, complete

interviews, assist in the development of procedures manual, assist in the development of databases could be provided by existing DVRPC staff.

Consultants would perform the following tasks: 1) develop a database for the new IEN and procedures (with a manual) for the operations of the network, 2) integrate network into existing operational procedures, 3) develop cost allocations for each stakeholder's participation, 4) provide system maintenance, and 5) develop training programs.

Many of the start-up activities associated with focusing the IEN on the Delaware Valley will be led by the Information Sharing/Operations Subcommittee. Once the new IEN is in place, much of the on-going coordination, evaluation and fine tuning would be the responsibility of the DVHOGs. An ongoing maintenance contract would be let for a consultant.

Scenario Costs

DVRPC's activities such as staff support to the Coordinating Council, Technical Task Force and Information Sharing/Operations Subcommittee, regional ITS planning, preparing responses to federal grant opportunities and sponsoring outreach/training courses could be accomplished for approximately $200,000 per year.

In developing the start-up cost estimates for this scenario, it was assumed that approximately 20 agencies would participate through the use of the IEN workstations, cell phones and pagers. Start-up activities would also include using a consultant to develop a new database and procedures manual for the IEN. With the help of the consultant, the participating agencies would need to modify and integrate their existing databases and operating procedures into the new process. The total start-up cost for these 20 agencies to fully participate in this scenario is estimated to be approximately $3.2 million. Capital costs may potentially come from the region's TIP.

On-going operating, maintenance and training costs are expected to cost about $1,000,000 per year and would most likely come from the participating stakeholders based upon cost allocations developed jointly by the consultant and the Information Sharing/Operations Subcommittee.

INTERACTIVE DATABASE SCENARIO

The Interactive Database Scenario was originally developed by the TTF in response to a request for grant applications issued by US DOT for ITS deployment. It represents an enhancement over the I-95 IEN by incorporating a database and graphical user interface to view real-time congestion levels, incident information, and VMS/HAR status on the transportation network. Besides data sharing, the virtual private network will provide a mechanism for operating agencies to confidentially share information and request assistance from one another. From a communications perspective, the Interactive Database will use internet protocols and off the self software to transmit and store information including graphics, database updates, video feeds, and e-mail messages. At each agency's workstation, a translation software (e.g. Common Object Request Brokered Architecture - CORBA), will merge individual agency databases into the regional database. Consultant(s) will be responsible for establishing the initial databases and base maps, and for maintaining the network servers and work stations. Institutionally, the Coordinating Council and TTF will become a standing DVRPC committee; however, a new Information Sharing/Operations committee will be formed to establish and operate the communication/coordination network.

Institutional Structure

Like the Decentralized Scenario, this alternative will give the Coordinating Council and TTF formal recognition by establishing them as standing DVRPC committees. This step would integrate the committees with DVRPC's planning and funding responsibilities. Formation of the Interactive Database will necessitate developing an MOU among cooperating agencies to establish a IS/O Committee, delineate agency roles and responsibilities, contracting procedures, and a cost allocation formula for sharing capital and operating costs. Since the IS/O Committee will be responsible for establishing the data sharing network, establishing procedures for information sharing and coordination, and for insuring compliance with the procedures, the MOU should explicitly define the committee's responsibilities, membership, committee bylaws, etc. The Interactive Database will eventually include all Tier I and many Tier II agencies in its operation.

Coordinating Council - Like the previous scenarios, the primary role of the Council, composed of the region's key ITS decision makers in the tri-state area, will be to develop regional ITS policy and provide a vision of future ITS activities in the region. The members of this committee would elect a chairperson and would meet on a semi-annual basis. DVRPC will provide staff support. An Executive Committee, composed of the CEOs of the Interactive Database agencies, will meet

annually to approve the next year's business plan and budget. Periodic meetings may be necessary to fulfill the Executive Committee's policy and budgetary oversight responsibilities over the IS/O Committee.

Technical Task Force - The TTF's functions include updating the regional ITS vision, recommending ITS projects for federal funding, maintaining the ITS Regional Architecture, and fulfilling US DOT's ITS consistency requirements. Bi-monthly meetings are envisioned with DVRPC staff providing administrative support. There would be a concerted effort to expand the ITS outreach program to include other Tier III organizations not presently participating, such as county 911 services and traffic reporting services.

Information Sharing/Operations Committee - This committee will plan, implement, and operate the Interactive Database. The Interactive Database focuses on information sharing among operation centers, and between operation centers and information service providers, and the media. An Executive Committee of the Coordinating Council will be responsible for approving the Interactive Database business plan including the pace of implementation, both in terms of services offered and organizations participating in the Interactive Database. A memorandum of understanding will be developed to formally establish the framework of the Interactive Database. In addition to implementing and operating the Interactive Database, the IS/O Committee will sponsor training courses for participating members on the Interactive Database procedures and interagency coordination. Since many of the operating agencies face similar problems in implementing and maintaining ITS technology, the IS/O Committee will also sponsor technical training courses offered by FHWA or other similar organizations. Since the committee is a regional consortium of ITS operators, it would be authorized to respond to federal ITS funding initiatives. Each year the committee would be responsible for formulating a business plan and annual budget for the Executive Committee's review and approval.

Information Sharing Among Organizations

The backbone of ITS information exchange will be center to center communication ultimately encompassing highway agencies, transit operators, toll authorities, county 911 operations, selected municipal emergency response agencies (along critical highway segments or interchanges), and adjoining metropolitan areas and states (including the I-95 Corridor Coalition). Types of information to be exchanged include traffic information, transit information, incident notification, request for traffic/transit information, CCTV images, traffic control information, weather

information, requests for coordination, quality of service data, and archived information. The system will be configured to provide audio warnings to operators when a message is directed to them.

Communications will be conducted over a secure virtual private network using existing off-the-self hardware and software, wherever possible, to minimize capital and operating costs. The communications backbone will be implemented in stages. Initially the Interactive Database network will rely upon a combination of existing telephone lines and fiber lines. As operating agencies construct fiber lines for their own ITS systems it is anticipated the backbone communication links will gradually shift to fiber. On-going operation and maintenance of the Interactive Database network will be provided through a contract with a consultant.

DVRPC staff has evaluated operations at 10 major regional agencies to determine how information sharing can be incorporated into agency standard operating procedures. Information collected includes: data needs, format, internal flows, available equipment and technical expertise. This analysis needs to be expanded to include all the Interactive Database members.

Based on the data needs and ITS architecture standards, the IS/O Committee will develop preliminary procedures for sharing information. Procedures will focus on issues such as when messages will be sent, frequency of updates, standard message contents and format, who should be notified, information confidentiality and distribution to the public, and non-real time information such as, advance construction notification, archived data). Products of this task may include maps to graphically display VMS/HAR locations and messages, databases for E-mailing and faxing data.

Telecommunication options will be evaluated. This will include evaluating communication platforms and determining what new equipment, if any, is required at each agency. It is anticipated the communication backbone will rely upon a secure virtual private network using existing technology (i.e., internet protocols) and existing telephone or fiber high speed communication lines as available. Fault tolerance, security, systems backup, and ability to update software/components will also be examined.

Training will be provided to familiarize operation center personnel to operate the system. An operations manual, covering a wide range of conditions and situations, will be developed to for system users. There must be provisions to adjust procedures to insure that the Interactive Database

network is integrated within existing agency procedures.

Operations Coordination

While the Interactive Database is itself a communications/information sharing network, not a coordination/operations mechanism, the magnitude and array of information it makes available to operation center personnel will ultimately foster greater cooperation among agencies. One of its underlying premises is to keep decisions at individual agencies instead of creating a new centralized staff. The individual agencies, when presented with sufficient information, will be able to make educated decisions based upon the information available and previous experiences in similar situations. The majority of incidents in the region are considered minor, and even most major ones become routine after a while. By providing operators basic information on highway and transit conditions, construction projects, status of VMS/HAR equipment, and detailed information on the location, severity, and duration of incidents and traffic management plans being implemented by the affected operator, the various agencies can assess the situation and make a judgement as to which course of action, if any, to take. The affected operator will also have an opportunity to view the Interactive Database to observe any spill back onto other agency's facilities and to determine what, if any actions other agencies may have taken. The Interactive Database will also support private messaging among operators, thus if an agency needs some form of assistance, instead of making a series of phone calls, a text message can be broadcast to several agencies simultaneously.

Augmenting the Interactive Database will be training courses, procedures manuals, and postmortem evaluations of major incidents. The Interactive Database is a sophisticated tool requiring extensive training on both its operation and coordination procedures. The procedures manual will also include extensive documentation on coordination procedures (e.g., pre-arranged detour routes, standard VMS message, etc.).

Information Sharing to the Public

The Interactive Database is not intended to provide information to the public initially as its database will include confidential information not intended for public disclosure. However, portions of the database will eventually be available to the media and other authorized information service providers. It is anticipated that private companies subscribing to the database will reformat the data for customized travel information services. Subscription fees can be used to partially offset the Interactive Database's operating cost. Ultimately, the cooperating agencies may permit

some database elements to be posted on the internet.

After Hours Coverage

Those stakeholders that operate 24 x 7 will have 24 hour access to the Interactive Database. If all agencies do not operate 24 x 7, some elements of the Interactive Database may not be available and the overall quality of information available after hours will diminish. If arrangements are worked out among agencies, the Interactive Database can support limited coverage of facilities whose operation centers are closed by permitting an open center to monitor highways through video streaming and utilizing available detectors. The center can initiate an incident response and/or notify the staff of the affected agency by cell phone or beeper. The substitute agency could also function as a temporary operations center until the staff of the affected agency is in place. This arrangement does not fully compensate for not having 24 x 7 operations. It can over burden the other centers and lack of familiarity with the facilities and local emergency responders will degrade the overall response to an incident.

ITS Planning

Project level planning and deployment will still reside at individual agencies under this scenario. Each operating agency would have its own plan for ITS deployment and may request federal funding for projects through DVRPC's TIP. They will also be responsible for certifying that the expenditure of federal funds for ITS deployments is consistent with the Regional ITS Architecture. Either through bilateral agreements, or under the purview of the IS/O Committee, agencies can also coordinate overlapping projects.

Regional level initiatives would be sponsored by the IS/O Committee. The committee will be responsible for the planning, design, installation and operation of the Interactive Database. It will be authorized to participate in other federal or private sector initiatives that might become available.

Developing the regional ITS vision and functioning as the custodian for the ITS Regional Architecture, will be the primary responsibilities of the Technical Task Force. To support that role, the TTF would encourage interagency coordination by sponsoring outreach programs to insure a broader participation in ITS planning activities. The TTF may endorse projects which apply for TIP funding.

Scenario Implementation

DVRPC Board formally establishes the Coordinating Council, Technical Task Force, and the authority to establish subcommittees. Coordinating Council establishes committee membership, agencies formally appoint a representative and an alternate to each committee. Both the Coordinating Council and Technical Task Force elect a chairman, approve bylaws, and establish meeting schedules. The Technical Task Force also develop an annual work program specifying DVRPC support activities, which then can be incorporated into DVRPC's annual work program.

The first step in initiating planning for the Interactive Database is to develop a preliminary agreement among key agencies on forming an IS/O Committee including committee membership, initial roles and responsibilities, and designating a lead agency for administering consultant contracts. The participating agencies also need to obtain funding, either from their own contributions or through the TIP, for a consultant(s) to develop a concept of operations. The conceptual plan will define in more detail information flows, the Interactive Database architecture, equipment and communication requirements, and capital and operating costs. Based upon the concept of operations, the IS/O Committee will develop a business plan delineating a project timetable, an overall budget with annual elements, and a cost allocation formula. At this point the participating agencies will have adequate information to determine whether they are committed to the Interactive Database. A formal MOU establishing the IS/O Committee and a policy level Executive Committee can then be executed.

Scenario Staffing

Establishment and operation of the Interactive Database requires far more substantial involvement by operating agency personnel than the previous scenarios. Agency staff need to be actively involved in consultant selection and supervision to insure the Interactive Database meets their needs. One of the premises of this scenario is that the system can be designed to operate transparently with limited operator involvement; however, accomplishment of this goal requires up front staff time with the consultants to develop the necessary software. Personnel will also have to receive training to properly operate the system. While no additional staffing is envisioned to operate the system, some IS/O Committee members may be so involved with the design and management of the Interactive Database that some of their other responsibilities may have to be assigned to other staff or additional personnel will be needed.

Consultants will be responsible for the design, start-up, and maintenance of the Interactive

Database. Due to the complexity of the proposed network it is assumed that a systems integrator will be contracted to oversee the design and implementation process. Supervision of the subconsultants will fall on the systems integrator. System maintenance, including software enhancements or equipment repairs, will also be contracted.

DVRPC will provide staff support to the Coordinating Council, TTF, and IS/O Committee. This can be arranged through DVRPC's annual work program.

Scenario Costs

Due to the high start-up costs associated with this scenario, it is anticipated the Interactive Database would be phased in over a multi-year period with all Tier I agencies on-line after the end of the second year followed by four new Tier II agencies on-line per year. It is estimated the total cost for the Tier I agencies is approximately $20,000,000 spread over a two year period. The annual start-up cost for Tier II agencies is approximately $7,000,000 per year over a four year period. Start-up costs include software development, server and communications hardware, leased fiber, interactive mapping, training, and consultants. In the third year of this implementation, when the first agencies become operational, the annual operating and maintenance cost is estimated to be $7,000,000. Leased fiber, hardware and software upgrades, training, and maintenance contracts are included in the costs. In addition, DVRPC staff support to the ITS committees is expected to be $200,000 per year.

CENTRALIZED SCENARIO

Unlike previous scenarios, this option creates a new entity which would be formed as a regional transportation partnership that contains its own staff, is housed independently, and is funded through stakeholder and other sources. The primary functions are to serve as a clearinghouse for transportation incidents and construction information and transmit that information primarily to the regional transportation agencies. It will also serve to convey incident and delay information to the media outlets.

This concept is primarily based on TRANSCOM and is meant to provide an objective view of its organizational structure. This new entity is a hybrid of both an information service provider and a traffic management center. The new partnership will provide a forum to coordinate operations

and construction projects, improve interagency communications, and initiate the implementation of various traffic management technologies to facilitate regional mobility across jurisdictional boundaries.

Institutional Structure

This multi-agency consortium could be incorporated as a non-profit organization that enters into an exclusive agreement with the operating agencies that have agreed to fund its operations. This new consortium would consist of several core agencies that provide sufficient resources to ensure its ongoing existence by providing staff and/or financial assistance to cover its basic operational expenses. The cost allocation among the participating agencies will be determined through negotiation.

Executive Board - This Board would be comprised of the chief executive officer of each agency. There may also be several other agencies that participate in the regional network, but do not contribute financially, and therefore would become non-voting members of the Executive Board. It would meet on an annual basis and review and approve the annual business plan, annual budget and update the cost allocation. Each contributing agency would have a vote on all matters. A member of the Executive Board would be appointed as Chairman with the term length to be determined by the Executive Board. The Executive Board is responsible for hiring a full time General Manager (GM) who shall oversee the day to day management and operational issues. The Chairman, with support from the GM, would develop the agenda and run the annual Executive Board meeting. The GM would be a non-voting member of the Executive Board.

General Manager - The GM is responsible for both hiring and overseeing the staff that is necessary to implement this scenario. This staff would either be hired to work directly for this new agency or the individual may work for a member agency but is assigned to work at the new agency's location. The GM will prepare the annual business plan and budget with approval from the Executive Board. The GM and the board would also work together to establish ITS priorities, and act as a liaison with the central staff and the regional ITS operators.

Operational Division - The operators are those that will perform the basic day to day activities of the central clearinghouse. Responsibilities include overseeing information on the flows of incident data, maintaining the communication links and acting as a liaison between the stakeholders to foster interagency coordination. The operations personnel will staff this new center 24 x7.

Another facet of the operations division involves incident management which entails monitoring incidents and distributing information to the relevant stakeholders, pre-incident corridor planning, pre-arranged detour routes, construction notification and post incident reviews. Another function of the operational division is to act as a liaison between the operating agencies and the media/ISP/public.

Administration Division - This division would perform all the administrative functions such as human resources, purchasing, accounting and contracting.

Technical Task Force - This scenario would also maintain the Technical Task Force that has been implemented under previous scenarios. The TTF will continue to operate independently from the newly created information clearinghouse. It is an opportunity to foster interagency coordination at the technical or operations level. The TTF membership represents the primary operators/planners of transportation facilities and services in the Delaware Valley region. A significant amount of effort will be made to obtain involvement from as many of the organizations from each of the three tiers of agencies.

The TTF's primary functions include developing/updating the regional ITS vision, recommending ITS projects for TIP funding, periodic agency updates, maintaining the ITS Regional Architecture and certifying the consistency requirements, sponsoring training courses/outreach programs, providing a forum for outside ITS vendors, preparing joint responses to federal initiatives, and discussing topics of current interest. Quarterly meetings are envisioned with subcommittees formed to deal with specific regional initiatives. DVRPC would also provide the staff support to this group.

Other Subcommittees - Other subcommittees may need to be formed on an as needed basis to respond to other activities that arise such as coordinated regional initiatives.

Information Sharing

This scenario serves as the central clearinghouse for transportation information. At this time, it is the basic service of coordination between the agencies, however it is possible to expand the role of this entity if called for. All of the data from the field is received at the individual agencies where it is analyzed. At this point, the individual agency will notify the clearinghouse about an incident, its location, estimated duration, impact on traffic flow (e.g. lane closures, detours, etc.).

Information will be updated in accordance to procedures.

Based upon information from the reporting agency, the central clearinghouse will notify other agencies. Procedures or notification criteria must be developed which outline the specific agencies that should be notified based on the location, duration and severity of an incident. The type of information shared maybe through phone, fax, pager and/or email.

The TTF would also be involved in creating an outreach program where they would sponsor workshops, agency tours and training classes. These workshops would be aimed at both the planning and operating agency personnel to obtain a better understanding of the data received from other organizations, discussing mutual problems of data collection and disseminating sensitive data. Based on the workshop topic and the target audience, several sessions to may be held to account for the various shift hours.

Operations Coordination

It is very important to note that, under this scenario, the central clearinghouse staff does not take the lead role in operations coordination and is not involved in the operations of any facilities. They support operations coordination by acting as a liaison between the agencies and try to view the bigger picture.

Staff may make recommendations or suggestion to the relevant agencies, especially with regards to construction. This center is able to monitor the different construction activities of each agency. When an incident occurs that may add additional volume to a facility under construction, they would be able to contact the project manager of that site to ask them to either postpone their construction or pull construction from some lanes to handle the additional volume.

The center staff would not participate in the operation or control of VMS/HAR messages. They may be able to help to coordinate the use of such messages, since they would have read only capabilities of monitoring the signs. Again they could make suggestions or recommendations to the various agencies to display incident data. As part of TTF outreach program, workshops may be held where the relevant agencies would discuss their internal and external procedures/criteria for posting VMS/HAR messages.

Information Sharing to the Public

The primary function of this new center is to serve as a clearinghouse for transportation incident and construction information. In addition to dissemination of information to all transportation agencies in the network, this new center plays an important role in conveying the incident and delay information to the media outlets, information service providers and the public. By gathering all the information and preparing it for public dissemination, the operating agencies's are released from this task allowing them to concentrate on the problems and clear the incident.

This center may also enter into partnerships with Information Service Providers to develop an individualized public notification process whereby individuals can pay for a service notify them, via fax, email or pager, of any incidents that my occur along their customized daily commuting routes.

After Hours Coverage

The new clearinghouse center would be staffed twenty-four hours a day and seven days a week. However, the incident data that it receives from other agencies is dependent upon those agencies having a manned 24 x 7 operations center. The central clearinghouse would only be able to provide limited after hours coverage for those operation centers that have limited hours. The clearinghouse would not have the capability to monitor their facilities, however, they would be available to contact the appropriate agency personnel if necessary.

ITS Planning

Planning for the deployment of ITS technologies or ITS programs will continue to be the responsibility of the individual agencies under this scenario. Each operating agency would have its own long range plan or vision for ITS deployment and would consider them in the development of their capital plans.

However, this scenario provides a means for developing a coordinated, regional ITS vision by allowing the TTF to act as a forum for regional ITS Planning. Several of the responsibilities of the TTF would involve developing a regional ITS mission statement, setting ITS priorities and making recommendations of ITS projects for the TIP and 12-Year Program funding. The TTF would also serve as the custodian for the ITS regional architecture and make sure that local projects adhere to ITS architecture consistency requirements. The TTF encourages interagency coordination by sponsoring training courses and outreach programs aimed at assisting the

stakeholders with the Regional ITS Architecture and maintaining National ITS consistency requirements when deploying their ITS technologies or programs.

Scenario Implementation

To implement this scenario, the operating agencies have to work together to develop an agreement which allows them to hire a consultant to analyze this scenario. The consultant will be responsible for taking an inventory of communication links between agencies, determining the staffing levels needed, taking inventory of both existing equipment and the equipment needed to implement this scenario and determining a cost estimate for the conceptual plan. Once the consultant has finished their initial work, the next step is to finalize an MOU and define agency roles and responsibilities and cost allocation of the new organization.

The design of a new center is the next phase towards implementation of this scenario. This includes the purchasing, installation, and testing of all new equipment that is necessary to house the staff of the central clearinghouse. The GM is responsible for hiring the initial staff that will be in charge of launching the new center. Operating procedures will be developed to outline all notification procedures and formats for information sharing. In addition, on-going training and workshops will have to be held for the new operating procedures.

Scenario Staffing

To operate this new center as a central clearinghouse, a staff of approximately 20-25 people will be necessary to perform the functions of GM, operators, technical support, ITS planning, administration and public affairs. This staff would either be hired to work directly for this new agency or the individual may work for a member agency but assigned to work at the new center.

In addition to the new center, each of the operating agencies will still have to maintain its current operation center. This may be done with their current staff, however, for maximum benefit of the entire scenario, some agencies may decide to expand their operations center to 24 x 7. This would require additional staff levels.

The Technical Task Force would require no direct costs or additional staff to the stakeholders, as this function could be done with existing DVRPC staff.

Scenario Costs

In developing the start-up cost estimates for this scenario, it was assumed that this new clearinghouse will initially employ only 5 full time staff out of the 25 that will be necessary when the center is fully operational. Start-up activities would include but not be limited to, renting and furnishing 7,000 square feet of new office space and procuring computers, work stations, software development and communication technology. The total start-up cost for this scenario is estimated to be approximately $2.5 million.

Annual operating and maintenance costs of the facility are expected to cost about $3.125 million per year. However, overhead and personnel costs of the additional 20 employees is a significant percentage of the yearly budget.

DVRPC's activities such as staff support to the Technical Task Force for regional ITS planning, preparing responses to federal grant opportunities and sponsoring outreach/training courses could be accomplished for approximately $200,000 per year.

REGIONAL OPERATIONS CENTER SCENARIO

This scenario creates a totally new entity, physically uniting, in a single facility, key personnel from participating agencies. It would coordinate and integrate operations and maintenance functions of transportation and traffic emergency management. The physical structure would be large enough to accommodate information and data feeds from each participating agency's ITS components since they will be removed from existing facilities. By physically housing regional transportation agency representatives together in a centralized location, this entity would provide immediate support for, and implementation of, successful and seamless partnerships, eliminating administrative and boundary constraints and providing effective pooling of finances, personnel and equipment resources. It is expected that the central staff of the new entity would focus on the technology and maintenance issues related to the ITS equipment, while each agency would supply staff to monitor conditions on facilities and initiate appropriate response.

Institutional Structure

An Executive Director of the Regional Operations Center would report to a board comprised of the chief executive officer from each of the agencies. This board will have voting powers, form sub-

committees, and have the ability to implement various programs deemed necessary through an enabling MOU, or a similar formal agreement. The Executive Director would have responsibilities such as hiring and overseeing a central staff and working with the Board in establishing regional priorities. The Executive Director would also serve as a liaison between the central staff and ITS operators from each participating agency.

The central staff, supervised by the Executive Director, would include the following divisions: Operations, Incident Management, Public Affairs, Technical Support, ITS Planning and Administration. A shift supervisor from the Operations division, present twenty-four hours a day, seven days a week, would be responsible for overseeing all information flows and coordination. In addition to central staff, Operations liaison officers from each agency would also be present twenty-four hours a day, seven days a week to monitor their respective facilities and coordinate with each other and the central staff. The Operations division would be responsible for working with individual agencies to develop procedures for coordination and information sharing.

Incident Management Division - This division would be responsible not only for construction notification, but also pre-arranged detours and post incident reviews. This division would be on-call twenty-four hours a day, seven days a week, and function as a regional command center for emergencies. The Operations liaison officers would work closely with this division during incidents and other situations which require the involvement of the Public Affairs Division.

Public Affairs Division - This division would be responsible for information dissemination to the media, including press releases, construction schedules and special events. There would be a public affairs officer overseeing a staff and on-call twenty-four hours, seven days a week. This division would have the ability to operate and manage live broadcasts, especially in the case of a major incident, via a separate media studio.

Technical Support Division - On-call twenty-four hours a day, seven days a week, the Technical Support division is responsible for maintaining in-house equipment and providing the engineering and design of ITS facilities. This division also oversees contractors for construction and maintenance of these facilities. Other facets to this division include providing software support and establishing design specifications.

ITS Planning Division - This division would be responsible for upholding the ITS mission statement

established by the board. This division would also work to establish ITS priorities for TIP funding and maintain ITS consistency requirements. Planning for the deployment of ITS technologies or ITS programs will continue to be the responsibility of the individual agencies under this scenario. Each operating agency would have its own long range plan or vision for ITS deployment and would consider them along with the regional agencies and ITS regional vision as they develop their capital plans. Individual agencies may request federal funding for ITS deployment through DVRPC's TIP, and would be required to certify that the expenditure of federal funds for ITS deployment would be consistent with the Regional ITS Architecture Requirements.

Administrative Division - Administration would perform functions such as human resources, purchasing procedures and accounting. Additionally, the administrative staff would be responsible for legal matters.

Information Sharing Among Organizations

Individual agency staff, under supervision of operations staff would work closely together and have the ability to immediately notify each other of incidents, their location, estimated duration, and possible impact on traffic flow. Liaison officers would be in close communication with their own dispatchers and posses contact lists with key personnel for possible deployment of forces after hours.

Since current information exchange procedures would be disbanded, communications consultants working with the Technical Support Division would select software and reroute existing data flows into the new facility and integrate the participating agency's existing infrastructure.

Training sessions for central staff, agency liaison officers and operations agency operations staff would be held to obtain a better understanding and sensitivity of data exchange with each other. This would be an ongoing process.

Operations Coordination

Staff would coordinate with each other in a centralized operations center. Prearranged plans could be established for recurring congestion. The Executive Director would serve as a liaison between the central staff and ITS operators.

Unlike previous scenarios, staff would have direct control of equipment such as HAR and VMS.

Strategic staging of field equipment for recurring events, such as snow storms, could be arranged. Also, the center could posses the capability to control and operate closed-loop systems for traffic signals. Criteria must be established for carrying out these procedures.

This scenario could provide the center with the capability to implement a regional traffic monitoring system using E-Z Pass transponders similar to the TRANSMIT Technology Program in the New York Metropolitan area.

Information Sharing to the Public

Staff would organize a centralized clearinghouse responsible for gathering the information that Public Affairs will disseminate to the public via the internet, contracts with cable TV companies, other media contacts and construction scheduling contacts, etc. This center could serve as the primary regional Information Service Provider (ISP), with possible partnerships to organize traveler information through a secondary ISP's customized pay-per-service fees. These partnerships could offset overall costs of operation. The regional Operations Center may contain viewing areas where the public and news media can monitor information during special and emergency events

After Hours Coverage

The Operations Center would be manned twenty-four hours a day, seven days a week. However, some of the individual agencies would not have operations or maintenance function on a twenty-four hour schedule. Therefore, a limited staff will coordinate on-call contacts if needed.

ITS Planning

Planning for the deployment of ITS technologies or ITS programs will continue to be the responsibility of the individual agencies under this scenario. Each operating agency would have its own long range plan or vision for ITS deployment and would consider them along with the regional agencies and ITS regional vision as they develop their capital plans. Individual agencies may request federal funding for ITS deployment through DVRPC's TIP, and would be required to certify that the expenditure of federal funds for ITS deployment would be consistent with the Regional ITS Architecture Requirements.

Scenario Implementation

The implementation of this scenario will require several steps. First, an initial agreement between agencies to initiate planning and design concepts will be developed. Then, with funding provided

by DVRPC TIP, consultant(s) would be hired to perform: a) cost estimates and allocations among participants, b) generation of a concept plan, c) a current inventory of the region's ITS equipment, d) an estimate of computer requirements, e) staffing requirements and f) integration procedures. After this step is complete, an MOU will be developed and finalized to define agency roles and responsibilities and budget. When this is agreed to a central staff will be hired and a location would be selected, either choosing to construct a new facility or lease existing office space. Existing operation centers would be phased out as the new regional operations center would be phased in. Finally, equipment specifications will be developed, equipment will be installed and tested and training and operating procedures will be developed

Scenario Staffing

The central staff would be composed of approximately 40 - 45 employees. A liaison staff would be comprised of six employees per agency for full twenty-four hour coverage.

Consultants would need to be hired to develop a database for the new operations center and procedures (with a manual) for operations of the network, integrate the network into existing operational procedures, develop cost allocations for each stakeholder's participation, provide system maintenance, and develop training programs.

Scenario Costs

The two largest capital cost components of this scenario are construction or refurbishment of a structure for a regional operations center, and relocation of communication equipment from the existing operation centers of ten organizations. Construction costs entail the operations room (consoles, monitors, wall screens), offices, meeting rooms, and other support facilities. Since this scenario assumes relocating ten existing operations centers to one centralized location, the existing field communications links will have to be rerouted by converting the old operation centers into remote communication hubs. Other start-up costs include concept design, systems integration, personnel and training. The start-up costs for this scenario are estimated to be approximately $75 million. The annual operating and maintenance costs, including over 40 new full time central staff are expected to be approximately $4.8 million. It should be noted, the Operation and Maintenance cost estimate does not include costs for individual agency staffing, which would be assumed to exist whether or not offices are co-located. It also does not include on-going maintenance of field equipment, which is the responsibility of individual agencies.

III. ANALYSIS OF COORDINATION SCENARIOS

In this chapter, the six coordination scenarios will be evaluated from a number of different perspectives. First, from the view point of different types of operating agencies, each scenario will be evaluated as to how well it satisfies each operating agency's objectives and its compatibility with their existing operating procedures. Second, agency procedures for after hours operations will be reviewed. Third, to evaluate the relative merits of the scenarios in terms of information sharing, each scenario will rated as to its effectiveness for sharing various categories of information. The format of the information exchange will also be highlighted to distinguish among the coordination options.

While agency interaction during an incident is important, it should not be the sole determinate in terms of selecting a coordination scenario. Therefore, each scenario will examined against a wider spectrum of regional ITS goals and objectives. Costs and staffing implications for each scenario will also be compared. Lastly, utilizing the above information, the strengths and weaknesses of each scenario will be highlighted allowing decision makers to better understand their implications.

Agency Objectives and Operations

In order to gain a better understanding of how readily each coordination scenario can be integrated into the operating agencies, DVRPC staff interviewed 10 regional agencies to determine how they function, their decision making process during incident conditions, and both their internal and external information flows. This section will briefly summarize their operations, interagency coordination, and coordination needs. To simplify this report, only five of the agencies will be described below: PennDOT District 6-0 Traffic Control Center (TCC), NJDOT Traffic Operations South, Delaware River Port Authority, SEPTA Operations Center, and PA State Police. The other agencies interviewed include: Philadelphia Department of Streets, Philadelphia Police Department, NJ State Police, PATCO, and SmarTraveler.

PennDOT District 6-0 Traffic Control Center - PennDOT's TCC focuses almost exclusively on the interstate and expressway system but is able to view some surrounding highways. Currently, only portions of I-95 and I-476 are monitored and coverage will shortly expand to include I-676, additional segments of I-95, and sections of I-76, US 202, US 422, PA 63 and PA 309. Incident detection is largely limited to monitoring CCTV cameras and scanning municipal police and state

police radio bands. The utilization of detectors will become more prevalent with the upcoming projects.

When an incident is detected, PennDOT's TCC typically notifies the Philadelphia Highway Patrol or the Pennsylvania State Police (depending upon jurisdiction). For local traveler notification, SmarTraveler, Express Traffic, and Shadow Traffic are notified; the DVHOGs are notified for a more regional distribution; and TRANSCOM and the I-95 IEN are notified for a larger distribution outside the region. PennDOT will personally notify NJDOT, DRPA, or DelDOT if there is a major incident that may impact their facilities and if additional resources may be needed. PennDOT maintenance districts are routinely notified about incidents as an alert, not as a dispatch, because organizationally they report to different assistant district engineers.

Where feasible, PennDOT monitors the emergency responders via CCTV, providing traffic condition information to the responders as needed. Video feeds from I-95 CCTVs are shared with the Philadelphia Police Radio Room. A similar arrangement for cameras on I-476 has been made with the Pennsylvania State Police; however, due to high telephone bills they are not routinely used.

SmarTraveler is under contract with PennDOT to disseminate traveler information to the public. As part of this arrangement, they receive live feeds from PennDOT CCTV cameras. Where variable message signs (VMS) signs are available, traveler information messages are posted by the TCC regarding downstream incidents. PennDOT's VMS policy differentiates between incidents on their own facilities and those that occur on other facilities. If an incident occurs on the same facility as the VMS, PennDOT will post a message when there is a lane blockage warning of delays ahead and sometimes suggesting which exit to use to avoid congestion. Potential detour routes are posted for lengthy closures. When an incident occurs on another facility (regardless of ownership), PennDOT will post a warning only if there is a complete road closure or major delays and the sign is located on a facility that feeds into the affected highway area.

PennDOT's recent move to new offices, with a substantial increase in floor space, provides the TCC an opportunity to expand monitoring coverage, utilize some of the field equipment not previously useable, and permits other agencies to co-locate at the TCC during incidents or special events. For example, during the Republican National Convention, the Pennsylvania State Police had an officer stationed at the TCC and there have been suggestions to make this a permanent arrangement. In terms of coordination expectations, PennDOT staff expressed interest in having an

interactive overview map showing current conditions on all major routes in the region, with an accompanying database detailing incident status and VMS status. Access to video feeds from other agencies was also requested. If SEPTA installs automatic vehicle location (AVL) systems on their buses, PennDOT would like to use this information to monitor traffic conditions. Lastly, PennDOT felt staff from the various regional operation centers should meet periodically to establish better personal rapport and understanding of each others needs and constraints.

NJDOT Traffic Operations Center South - Traffic Operations Center (TOC) South is an integral part of NJDOT's Operations South, which covers highway maintenance, electrical maintenance (traffic signals), and construction for the ten southernmost counties of South Jersey. A New Jersey State Police officer is permanently assigned to the TOC as a liaison. Unlike PennDOT, the primary focus of NJDOT's traffic operations is the arterial street system. This is reflective of the limited number of expressways in South Jersey and NJDOT's responsibility for maintaining their arterials. Since the TOC covers an extensive area, they generally rely upon NJDOT maintenance personnel and state and local police for incident notification. In addition, emergency service patrols on I-295, I-76, NJ 55 and NJ 42 are a major source of incident detection on these facilities. NJDOT also uses sensors and CCTV cameras from their Multi-Arterial Traffic System (MATS) as a source of incident detection and verification. Its scope of coverage, however, is currently very limited. NJDOT plans to remedy this by installing additional ITS equipment.

When an incident occurs, the TOC notifies NJDOT maintenance crews (TOC can directly contact the maintenance crews), the traffic reporting services, transportation management associations, and the appropriate county communication center (911) and local police. All responses to an incident are recorded in a database. There is no official VMS policy. Generally for incidents on non-NJDOT facilities, the significance of the incident and its proximity to NJDOT's VMS signs determine whether a message is posted or not. Typically when a accident occurs on a non-NJDOT facility such as a DRPA bridge or in Pennsylvania, NJDOT will make a phone call to determine how serious the situation is and what actions are being undertaken. Their response, if any, depends upon the current conditions reported and NJDOT's previous experience with similar situations. In most instances NJDOT's only response is to monitor traffic conditions.

In terms of incident response, the most frequent type of incident is a minor accident on an arterial, which is normally handled by the local police. For more serious incidents, NJDOT supplements its maintenance crews with an Incident Management Response Team (IMRT). Their primary focus is

the maintenance of traffic, which includes keeping the TOC up to date and insuring that the proper resources are available to clean up the accident site. IMRT crews carry portable VMS signs, flares, cones and other equipment to facilitate traffic control at the scene. TOC staff then relay IMRT reports to traffic reporting services and other operating agencies.

In terms of regional coordination, NJDOT's TOC South biggest problem is obtaining timely information from the local police. Frequently local police are unwilling to provide information to the TOC requiring a follow up call by the New Jersey State Police. While the IEN is useful, NJDOT would prefer a system that is more focused on the region rather than hearing about accidents in New York or Washington and includes interactive graphics with video feeds from other agencies. More formalized protocols are needed on who to notify and when. NJDOT recently contracted with SmarTraveler to provide traveler information for South Jersey. The agreement calls for SmarTraveler to have staff stationed at the TOC. There are also plans to relocate the entire South Jersey operations including the TOC to a larger building. This presents an opportunity to expand and improve TOC operations.

SEPTA Operations Center - SEPTA is in the process of consolidating all command functions for its various operation divisions in one location. The center is supervised by a Chief Control Center Officer, both bus and rail directors, and assistant directors who function as shift supervisors. The main operating divisions include Regional Rail Operations, City Bus and Rail Operations, and Suburban Bus and Rail Operations. Also located in the operations center are SEPTA Police dispatchers. As the center becomes fully operational over the next 3-4 years, power dispatchers and SEPTA press officers will also be co-located there.

SEPTA's operation center primarily functions as a command/control point. Operation center staff have the ability to monitor the transit system and reroute trains and buses as required. When an incident occurs, they notify a line or street supervisor (for rail or buses respectively) to investigate and manage the situation. Depending upon the supervisor's assessment, the operations center will notify appropriate personnel (e.g., power, signal, maintenance personnel, etc.) who in turn are responsible for sending additional resources to the incident site. If police assistance is necessary, they will also be dispatched through the operations center. Supervisors are responsible for on-site supervision and coordination until the situation is rectified. SEPTA has extensive documentation on emergency procedures including alternate service plans, winter weather plans, hurricane plans, work stoppage plans, etc.

After the initial assessment and notifications are completed, the operation center will notify the public affairs department, which is responsible for initiating media notifications. Both the operations center and public affairs have the capability to update travel information on SEPTA's web site. Operations center personnel also notify vehicle operators and/or cashiers, who are responsible for notifying en route passengers about the incident and any delays or detours.

Because many SEPTA regional rail lines operate on Amtrak rights of way, SEPTA must coordinate with Amtrak's Central Traffic Electrical Control (CTEC) located at 30th Street Station. While SEPTA is generally aware of the location of their trains through interaction with CTEC, there are frequent lapses in communication, and more detailed information on train positioning is critical to seamlessly route trains into 30th Street Station. A possible long-term solution is to install a direct connection to Amtrak's CTEC which would enable SEPTA to directly monitor their trains.

SEPTA also has a substantial cooperative relationship with the City of Philadelphia. Even though the SEPTA Police and Philadelphia Police Departments are two separate organizations, SEPTA Police have access to the city's police computer system and they routinely work together responding to incidents on SEPTA properties. SEPTA's control center works closely with the city's Managing Director's Office in coordinating special events, and they also have a representative in the Philadelphia Emergency Command Center during emergencies such as snow storms.

In addition to Amtrak and the City of Philadelphia, SEPTA routinely obtains traffic information from SmarTraveler and PennDOT's TOC. SmartTraveler shares information about traffic conditions throughout the city and suburbs, and PennDOT's TOC sends faxes about incidents on I-76. SEPTA expressed interest in obtaining video feeds from PennDOT, SmarTraveler, and/or Metro Traffic. Other than NJ Transit, which shares some trackage with Amtrak and SEPTA, there is little interaction between SEPTA and other regional agencies. In terms of providing information to a regional database, the vast majority of what SEPTA internally classifies as incidents are typically disabled buses or minor accidents. SEPTA's computer aided dispatch system would have to be modified to filter out what external agencies would consider non-events. While SEPTA is keenly interested in travel information from other agencies that would impact their bus operations, they do not want to be overloaded with extraneous information. SEPTA is planning a demonstration project to test a bus AVL tracking system. If it is successful, it could be extended as funding permits, and eventually could provide traffic condition information to other agencies.

Delaware River Port Authority - DRPA's sole focus is its four bridges and their approach roads. PATCO, a subsidiary of DRPA, was analyzed but for brevity is not reviewed in this report. Through agreements with PennDOT and NJDOT, DRPA's patrol coverage in some instances extends up to 2-3 miles past the actual bridge along its approach roads. At each bridge, the primary responsibility for traffic and incident management lies with the police lieutenant responsible for that specific bridge. When the lieutenant is not present a shift supervisor (normally a sergeant) oversees police operations. All other bridge operations including toll collection and maintenance are the responsibility of the bridge manager. Currently, each bridge has its own radio room.

Typically an incident is first reported either by a 911 call, motorists notifying toll collectors, or DRPA police patrols. When the initial notification is made through a 911 call, municipal police and fire are automatically sent to the scene. County 911 services and the toll collectors notify the bridge radio room who in turn dispatches an officer to the scene. Procedures call for the officer to make a determination as to the severity of the incident as well as the resources required. This information is relayed to the shift supervisor who can assign additional officers and request assistance from their counterpart in bridge operations. For major incidents, the bridge lieutenant will be notified and additional police/maintenance resources can be redirected from other bridges. The radio room keeps a running log to track the incident.

The lieutenant or shift supervisor determines if the incident will affect other agencies and whether they need to be notified. Each radio room is equipped to send out notices using DVHOG's fax list. DRPA personnel will modify the fax list depending upon the situation. Typically when NJDOT or PennDOT receives a fax, they will call the radio room to inquire about the incident, and ask if they can lend any assistance or resources. DRPA relies upon TRANSCOM, which is on the DVHOG's fax list, to notify the traffic reporting services and the I-95 IEN. Each bridge is assigned three portable VMS signs that can be used to notify motorists about an incident. If necessary, VMS signs from other bridges may be relocated to provide additional support. The signs are usually placed on the approach roads at key junction points. DRPA also relies upon NJDOT for supplemental postings on their VMS signs. Because the bridges share radio frequencies, DRPA has the option to have one bridge focus on incident response, while another bridge's radio room will help to coordinate the response with external agencies. In terms of incidents on other facilities, DRPA is willing to employ VMS signs if there is a road closure of more than one hour's duration.

DRPA is planning a number of improvements than can significantly impact their traffic and incident management program. Planning for a central operations center has just been initiated, the new centralized control center is intended to allow DRPA to increase their external coordination. DRPA also plans to install CCTV cameras on all bridges by the end of this year. Also under consideration is an automated records management system that includes a computer aided dispatch system to log incident information.

In terms of agency coordination needs, internal video sharing is a high priority. Additional IEN training is required. DRPA staff would prefer relying upon faxes or phone calls to contact other agencies rather than more advanced systems due to the training problems associated with the IEN. They also feel there is inadequate coordination after hours because NJDOT and PennDOT do not have 24 X 7 operations. Another suggestion was for the region to more effectively utilize the State Police Emergency Network (SPEN) to foster communication between field personnel and operation centers during an incident.

Pennsylvania State Police - Troop K is headquartered at Belmont Barracks with additional barracks in Media and Skippack and is responsible for patrolling a large component of the expressway system in the Pennsylvania portion of the region, outside the City of Philadelphia. This includes I-76 west of City Avenue, I-95 south of Philadelphia, portions of I-476, US 422, and PA 309. Trevose Barracks (Troop M) is responsible for I-95 north of Philadelphia while Troop T patrols the Pennsylvania Turnpike. Generally there are three patrol shifts with a corporal acting as a shift supervisor.

The radio room in each barrack is the focal point of incident coordination. They are responsible for dispatching officers and serve as the link between the field command center and outside agencies. State police are usually first notified of an incident by county 911 services in response to a cellular phone call. Other means of notification are direct calls from the public to the radio rooms or police patrols. When a phone call is received from 911, the radio room notifies the officer assigned to the patrol zone. After the officer arrives at the scene and assesses the situation, he can contact the radio room for supplemental resources, including additional state troopers, fire equipment, emergency medical services, or tow trucks. There is some confusion over whether the radio room or county 911 services is responsible for notifying municipal police, such as when an expressway is closed. The radio room is also responsible for making all follow-up calls including notifying PennDOT's TOC. State police feel it is the TOC's responsibility to notify PennDOT maintenance crews,

TRANSCOM, and other traffic reporting agencies. If the incident involves lane or road closures, the state police have no traffic control resources and must rely upon the local municipal police for assistance. If an incident occurs in another state they are usually notified about it by PennDOT; however, other than notifying patrol officers, no other actions are usually taken.

The PA State Police are generally satisfied with their existing institutional relationships. They routinely obtain accident information from county 911 services and PennDOT's TOC. If they need to contact other state agencies or other police departments, their operation manuals provide the radio room staff with all appropriate phone numbers and contact lists. Nonetheless, a number of opportunities for improvement were identified. Radio room limitations constrain the state police's ability to participate in information sharing. Usually only two radio dispatches are on duty, and between answering phone calls, acting as receptionists, dispatching troopers, and functioning as incident coordinators, there is insufficient manpower to take on any additional tasks. Even though the Belmont Barracks can obtain live video feeds from PennDOT these are not utilized due to the radio room under staffing and costly phone bills. When the state police eventually implements a consolidated computer aided dispatch system, there may be opportunities for improved coordination, including positioning an officer at PennDOT's TOC and standardizing notification procedures with local police.

After Hours Operations

For this analysis close to 20 regional organizations were examined as to their after hours procedures. To be considered to have a 24 x 7 operation, two conditions must be satisfied: 1) the organization's facilities should be continuously monitored either by ITS equipment (CCTV, detectors), police or transit vehicle operators and 2) a local control/command point staffed around the clock in constant contact with staff (police radio room, dispatch center, operations center). The vast majority of the organizations in this region operate 24 x 7. For example, all toll authorities have a police force responsible for patrolling the toll facility, officers are also largely responsible for staffing the control centers. Generally, transit properties operate on a full time basis. Even when trains or buses are not running overnight, control center staff are on duty preparing for the next morning's operations.

Although they do have some type of after hours notification procedures in place and there are state and local police patrolling their facilities, PennDOT District 6 TCC and NJDOT TOC South do not typically have staff located in their traffic control centers during the overnight or weekend time periods. As indicated in Table 1, PennDOT and NJDOT are the only key stakeholders in the region

that do not provide the type of after hours coverage defined above. The following are several examples of the procedures that some of the region's stakeholders employ to provide after hours coverage:

PennDOT's traffic control center hours of operation are from 5:00 AM to 8:00 PM Monday through Friday with after hours and weekend special event coverage as needed. On a typical weekday, the ITS equipment used for monitoring PennDOT facilities is turned off at 8:00 PM and not turned on again until the next morning. Also, there is no staff present in the TCC after 8:00 PM. PennDOT has made an arrangement to redirect after hours calls concerning incidents to TRANSCOM in North Jersey and to the local traffic reporting services. These groups can then page PennDOT Traffic Control Center staff at home if it is deemed necessary. The TCC provides travel information to the public through SmarTraveler and the traffic reporting services. Again, on a typical weekday, this information is only made available during operating hours.

NJDOT's TOC is staffed from 4:00 AM to 8:30 PM Monday through Friday and on summer and holiday weekends. After hours, a member of the IMRT team is on call. Emergency calls to the TOC are rerouted to the New Jersey DOT Central Dispatch located in the State Police Headquarters in West Trenton. Central Dispatch will contact the IMRT duty officer on call and he or she will determine NJDOT's response. Some ITS equipment can be operated remotely or, if necessary, the duty officer will send someone into the TOC.

SEPTA's operations center is staffed 24 hours a day, seven days per week. Line and street supervisors are also on duty around the clock.

DRPA currently has an individual control center at each of their four bridges which oversees traffic/incident management, toll collection and maintenance. A police presence is maintained in the control centers and on the bridges 24 hours a day, seven days per week. Since the collection of tolls is a continuous function, a bridge manager is also present around the clock.

TABLE 1
After Hours Coverage

Agency	Control/Command Point	Staffed 24 X 7	Other
AMTRAK	Central Traffic Electrical Control	X	
Delaware DOT	Operations Center	X	
Delaware River Port Authority	Bridge Radio Room	X	
New Jersey DOT	Traffic Operations Center South		Operations: 4 a.m. - 8:30 p.m. weekdays & holidays. After hours calls forwarded to NJDOT Central Dispatch in W. Trenton. Can contact TOC staff at home.
New Jersey State Police	Barracks Radio Room	X	
New Jersey Turnpike Authority	Operations Center	X	
New Jersey Transit	Central Communications Center	X	
PATCO	Center Tower	X	
Pennsylvania DOT - District 6	Traffic Control Center		Operations: 5 a.m. - 8 p.m. weekdays & special events. Formal agreement with TRANSCOM and/or local traffic reporting services to contact TCC staff at home for after hour incidents.
Pennsylvania State Police	Barracks Radio Room	X	
Pennsylvania Turnpike Commission	Harrisburg Control Center	X	
Philadelphia Police Department	Police Radio Room	X	
Philadelphia Streets Department	Municipal Radio Room	X	
SEPTA	Operations Center	X	
SmarTraveler	Control Center	X	
S J Transportation Authority	State Police Communications Center	X	
TRANSCOM	Operations Center	X	

The Pennsylvania State Police operate around the clock on three patrol shifts with a corporal serving as a shift supervisor. Each barrack has a radio room which serves as the hub of all communications. The radio room is responsible for dispatching officers, and provides the link between the field command center, outside agencies and other barracks. Since officers are on patrol around the clock, the radio room is staffed 24 hours a day, seven days per week.

Analysis of Information Flows and Information Exchange Methods

ITS coordination is fundamentally about information sharing; the type of information and the means of information exchange. This section will analyze the type of information flows supported by each of the coordination scenarios: incident data versus travel condition data, highway information versus transit information etc. The means of the information exchange, such as fax, e-mail, or video images will also be discussed.

Information flows between operation centers are defined by the ITS Regional Architecture. Following guidelines established by the national architecture, DVRPC conducted a year long interactive effort with the ITS Technical Task Force to develop the regional ITS architecture. As per the guidelines, the task force prioritized "User Services," namely what are the local ITS requirements. Traffic control, incident management, public transit management, and pre-trip and en-route traveler information were all rated as high priority user services. After these functions were identified, the task force then evaluated the applicability of over 40 "Market Packages." Market Packages represent a standard set of subsystems, such as traffic management or emergency management and architecture flows between the subsystems, such as video images, incident notification, or traffic data, that can be used to implement desired User Services.

While the ITS Regional Architecture report is still in draft format, the architectural requirements have largely been defined and can be used to evaluate the six cooperation scenarios. From an architectural standpoint, information sharing and coordination must address architecture flows between four types of centers: traffic management (e.g., NJDOT, PennDOT, Philadelphia Streets Department), emergency management (e.g., NJ State Police, PA State Police, Philadelphia Police Department), transit management (e.g., SEPTA, PATCO, NJ Transit), and information service providers (e.g., SmarTraveler, Metro Traffic, Express Traffic). As shown in Table 2, for each pair of centers, there are different architecture flows. For example, using the national architecture nomenclature, the architecture flow between traffic management centers consists of "traffic

TABLE 2
AVAILABILITY OF INFORMATION BY COORDINATION SCENARIO

Architecture Flow (Center to Center)	Existing	Cooperative	Decentralized	Interactive	Centralized	Regional
Traffic Information Coordination *(TM-TM)*						
Traffic data	★	★	★	★★★★	★	★★★
Congestion data	★	★	★★	★★★★★	★	★★★★
Incident data	★★★	★★★★	★★★★	★★★★	★★★★	★★★★★
VMS/HAR status/request messages	★★	★★★	★★★★	★★★★	★★★★	★★★★★
Incident Notification *(TM-EM)*						
Incident nature, location and severity	★★★	★★★★	★★★★	★★★★	★★★★	★★★★★
Incident Response Status *(EM-TM)*						
Clearing time, severity	★★	★★	★★★	★★★★	★★	★★★★★
Current Network Conditions *(TM-EM)*						
Road conditions/traffic information	★	★	★	★★★★★	★★	★★★★★
CCTV images	★★	★★★	★★★	★★★★	★★★★	★★★★★
Resource Deployment Status *(TM-EM)*						
Resources available and current status	★	★	★★	★★★	★	★★★★★

Ratings: ★ very poor ★★ poor ★★★ fair ★★★★ good ★★★★★ very good
Centers: TM traffic management EM emergency management TRM transit management ISP information service provider

TABLE 2
AVAILABILITY OF INFORMATION BY COORDINATION SCENARIO

Architecture Flow (Center to Center)	Existing	Cooperative	Decentralized	Interactive	Centralized	Regional
Traffic Information for Transit *(TM-TRM)*						
Congestion data	★	★	★★	★★★★★	★★	★★★★★
Incident data	★	★★★	★★★	★★★★	★★★★	★★★★★
Transit System Data *(TRM-TM)*						
Schedule and fare information	★	★	★	★★★★★	★	★★★★
Incident/delay information	★	★★	★★★	★★★★★	★★★★	★★★★★
Traffic Information *(TM-ISP)*						
Traffic information	★	★	★	★★★★	★	★★★
Road and weather conditions	★	★	★	★★★★	★★★	★★★★
Incident information	★★★	★★★	★★★	★★★★	★★★★	★★★★
Transit Information *(TRM-ISP)*						
Schedule and fare information	★★★	★★★	★★★	★★★★	★★★	★★★★
Schedule adherence	★★★	★★★	★★★	★★★★	★★★★	★★★★
Transit Incident Information *(TRM-ISP)*						
Location, duration, and re-routings	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★

Ratings: ★ very poor ★★ poor ★★★ fair ★★★★ good ★★★★★ very good
Centers: TM traffic management EM emergency management TRM transit management ISP information service provider

TABLE 2
AVAILABILITY OF INFORMATION BY COORDINATION SCENARIO

Architecture Flow (Center to Center)	Existing	Cooperative	Decentralized	Interactive	Centralized	Regional
Transit Management Coordination *(TRM-TRM)*	★★	★★	★★	★★★★★	★★	★★★★
Schedule and fare information	★★★	★★★	★★★	★★★★	★★★★	★★★★
Schedule adherence	★★★	★★★	★★★★	★★★★★	★★★★★	★★★★★
Transit incidents, location, duration, re-routings						
Transit Emergency Data (TRM-EM)						
Notification, response coordination	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Transit Emergency Coordination Data (EM-TRM)	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Incident information						

Ratings: ★ very poor ★★ poor ★★★ fair ★★★★ good ★★★★★ very good
Centers: TM traffic management EM emergency management TRM transit management ISP information service provider

information coordination" data. Traffic data, congestion data, incident data, and VMS status/message are different elements of traffic information coordination.

For each architecture flow and their respective data elements a qualitative attempt was made to judge how effective each coordination scenario performs in conveying information. For example, in Table 2, the availability of traffic data under Existing, Cooperative, and the Decentralized Scenarios are considered very poor because none of these scenarios will provide traffic flow status, travel times, video images, sensor output, etc. The Interactive Database Scenario was rated very good but while it will exchange this type of information, its effectiveness is currently limited by data availability. The availability of traffic data under the Regional Operations Center Scenario was judged as good because it represents a mechanism for some agencies to obtain information indirectly from each other through the regional operations center.

The means of data exchange determines the magnitude of information available for interagency data sharing, degree of technical expertise required, and lastly the technology needed to support it. The wide disparity in capital and operating costs among the scenarios are largely attributable to underlying communication technology. This section describes the type of data and how it will be transmitted. A summary can be found in Table 3.

Telephone - All scenarios will utilize phone services because even with the most advanced systems there will be circumstances where operators will need immediate personal contact and feedback. Phones will be a primary communication means for the Existing, Cooperative, and Centralized scenarios. In the latter two scenarios, digital phones in lieu of hard wired phones may become the preferred technology because of transferability among personnel. In the Decentralized, Interactive Database and Regional Operations Center scenarios, phones will play a secondary role in interagency communications.

Fax - The DVHOGs' fax list is currently a major means of sharing information among highway agencies in the region. With modifications in terms of range of data and participants, faxes will remain a primary source of information exchange under the cooperative scenario. Under the centralized scenario, faxes will be one choice of a larger menu of communication devices for an agency to select to receive or send information.

Pager - Because of their flexibility in terms of transferability among operation center personnel and

TABLE 3
INFORMATION EXCHANGE METHOD AMONG AGENCIES
BY COORDINATION SCENARIO

Scenario	Information Exchange Method						
	Phone	**Fax**	**Pager**	**E-Mail**	**Database**	**GUI**	**Video**
Existing	★	★					
Cooperative	★	★	★	★			
Decentralized	★		★	★	★		
Interactive	★			★	★	★	★
Centralized	★	★	★	★			
Regional	★				★		★

the ease to send broadcast messages, it is assumed they will be one of the primary means of communication under the Cooperative and Centralized scenarios. In the Decentralized Scenario pagers will perform a secondary role to the IEN.

E-Mail - For many scenarios, e-mail will be one choice of a larger menu of communication devices for an agency to select to receive or send information.

Database - Three scenarios will use databases in dissimilar ways. In the Decentralized Scenario, an IEN base map will graphically display locations of incidents, major delays, construction and maintenance locations, and VMS/HAR locations. A manually entered static database will show basic reference information pertaining to the unusual condition. In the Interactive Database Scenario, a dynamic database integrated with a graphic user interface (GUI) will display a map(s) summarizing transportation conditions and supplemental details on any transportation link or warning icon queried. The Regional Operations Center Scenario will utilize databases as an archival resource logging the latest incident, maintenance, traffic control and traveler information activities.

Graphical User Interface - Under the Interactive Database Scenario there will be graphical displays, with underling databases, documenting travel conditions, incidents, maintenance and construction activity, and information on agency responses to unusual conditions.

Video - Real time video images from CCTV cameras will be available only in the Interactive Database and Regional Operations Center scenarios. Bandwidth requirements to push real time video in a satisfactory manner restrict its application to only those scenarios which also require wide bandwidths such as the Interactive Database Scenario. Relocating operation centers to a joint operations center will require rerouting all field data feeds, including video, to the new regional center.

Capital and Operating Cost Comparison

In an ideal situation, selection of an ITS coordination scenario would be based solely upon functionality, not costs. Unfortunately, technology is costly and consequently there is a wide disparity in capital and operating costs among the six scenarios which needs to be addressed. This section attempts to explain the differences by documenting some of the major cost items associated with each scenario. A comparison of the costs is presented in Table 4 and more detailed costs estimates are presented in Appendix E.

Existing Scenario - This scenario essentially represents the status quo and therefore has no costs associated with it other than DVRPC maintaining the TTF and Coordinating Council. With completion of the regional ITS architecture, a decision on information sharing, and completion of an ITS vision, funding for ITS planning will be at a lower level than currently required by DVRPC.

Cooperative Scenario - This scenario stresses improved information sharing and decision making through the use of low tech devices such as phones, faxes, pagers or e-mail. It is assumed there will be no capital outlays. An increase in the annual operating costs is primarily associated with a more extensive outreach program to foster cooperation among agencies through more frequent meetings and training programs.

Decentralized Scenario - Under this scenario a locally customized IEN will be created. The largest implementation cost components are associated with providing computer work stations with high speed communication interfaces and developing a regional base map. The internet compatible base map will display roads and transit lines of regional significance, and CCTV camera and VMS sign

locations. GIS software will need to be modified to permit manual input of real time traffic conditions such as accident locations, congestion alerts, or construction/maintenance activity. A

TABLE 4
START-UP AND ANNUAL OPERATING COST COMPARISONS

Scenario	Start-up Capital Costs	Annual Operating Costs
Existing	None	$100,000
Cooperative	None	$400,000
Decentralized	$3,200,000	$1,200,000
Interactive	$20,000,000 Tier I Agencies (First 2 Years) $7,000,000/Year Tier I Agencies (Years 3-6)	$7,000,000 for All Tier I Agencies (after Year 2) $13,000,000 for All Tier I and Tier II Agencies (after Year 6)
Centralized	$2,500,000	$3,325,000
Regional Operations Center	$75,000,000	$4,800,000 (Excludes Agency Staff Support)

systems integrator and software and communication consultants are also included in the costs. To keep start-up costs down, this scenario does not include an interactive database or video feeds. Annual operating costs include upgrading hardware/mapping, internet access, maintenance contracts and training costs.

Interactive Database Scenario - The magnitude of the start-up costs are mainly attributable to two system requirements: 1) the need to seamlessly integrate an interactive database, and 2) the need to deliver realtime video feeds. Because the costs are fairly exorbitant, it was assumed this scenario will be implemented over a six year period, with 10 key agencies in operation after the first two years and 16 additional agencies phased in over the next four years.

The National Transportation Communications for ITS Protocol (NTCIP) Class E protocols for center-to-center communications has designated the Common Object Request Broker Architecture (CORBA) as the medium to facilitate interoperability among transportation operation centers. Under the CORBA model, an operation center can make any type of request, such as "are there any incidents on I-76" or "where are the locations of NJDOT maintenance crews". CORBA transparently finds the requested information regardless of where the information is stored on the network or in what format it is stored without the requestor knowing where the information came from. This flexibility to find information across a wide spectrum of operation centers and software formats is expensive. Software developers must write "wrapper code" to translate every agency's databases and develop sets of protocols to respond to requests. Without a detailed examination of each agency, to ascertain the number of databases, formats, network configurations, or even the need to create databases, it is extremely difficult to estimate the cost to implement a CORBA-based architecture. Based upon experiences in other regions, costs range from $500,000 to $1,500,000 per agency depending upon complexity. Ultimately, build out assumes 30 organizations will participate in the Interactive Database.

Bandwidth requirements for real time video sharing will ultimately lead to a fiber optic network. With the cost of fiber leasing dropping and many agencies constructing their own systems, a fiber based network is not an unreasonable assumption. Without an in-depth analysis of each agency, an order of magnitude cost was estimated for fiber installation, communication interfaces, and workstation hardware and back-up systems. Annual operating and maintenance costs are based on an industry standard of 20 percent of implementation costs.

Centralized Scenario - In a TRANSCOM type system, the technology costs are secondary in comparison to personnel costs. This scenario will utilize fairly low cost technology such as pagers, digital phones and/or e-mail to advance the exchange of information. Start-up costs include initial staffing, renting or renovating offices, and purchasing equipment and furniture. A complement of 20-25 full time positions has been estimated, with 5 individuals required during the implementation phase. Creation of mapping and databases for the centralized staff to keep track of congestion and incidents, very similar to the IEN mapping requirements, is another large component of the start-up costs.

Regional Operations Center Scenario - The two largest capital cost components of this scenario are construction of a regional operations center, and relocation of communications equipment from

existing operation centers. Construction costs entail the operations room (consoles, monitors, wall screens), offices, meeting rooms, and other support facilities. Since this scenario assumes relocating various operations centers to one centralized location, the existing field communications links will have to be rerouted by converting the old operation centers into remote communication hubs. The most significant recurring cost is staffing. The cost estimate assumes over 40 new full time positions, complementing existing agency staff. It should be noted, the cost estimate does not include costs for agency staffing which was assumed to exist whether or not offices are co-located. Nor does it include on-going maintenance of field equipment which is the responsibility of individual agencies.

Regional Perspective

The introduction of this report framed institutional coordination around three issues: information sharing, traffic management, and after hours operations. However, from a regional perspective, institutional coordination must satisfy a number of broader based regional goals and objectives ranging from such obvious criteria such as funding levels and institutional relationships to less obvious criteria such as the ability of the region to attract private sector investment in ITS programs. In this section, a broader set of criteria will be identified which can be used to evaluate the relative merits of the coordination scenarios.

In the preliminary stages of the larger ITS institutional coordination study, the Coordinating Council suggested establishing a set of goals and objectives to guide ITS planning in the region. In accordance with this request, a set of goals and objectives was presented to the TTF. A review of these goals and objectives revealed several wide ranging criteria that could be used to evaluate the alternatives scenarios. Below is a select list of objectives, taken from the set of ITS goals and objectives, applicable to this analysis with an accompanying set of performance measures.

- *Create a more formal institutional framework involving operating agencies and non-traditional partners* - Does the information sharing mechanism focus on a broad array of agencies or just a few select agencies? Are non-traditional agencies adequately incorporated into the planning and information sharing processes? Does the cost or technical expertise needed for participation preclude any agencies?

- *Emphasize incident management and traffic control, pre-trip and en-route highway and transit information, public transportation management and electronic toll/fare*

collection - Does the coordination scenario account for all types of travel modes? Does it provide a mechanism to disseminate basic and more advance types of travel information to the public?

- *Implement initiatives that provide real-time information on alternative routes and modes* - Does the information sharing scenario provide for travel information or is just incident driven? Will travel information on just a few highways and transit lines or can it be expanded to other facilities as they become wired?

- *Implement programs to address critical needs of emergency responders* - Are emergency service providers incorporated into the information sharing and decision making process? Will the information being generated be useful to the incident responders?

- *Develop partnerships with the media and other businesses to spread travel information* - Does the information sharing scenario make provisions for media participation?

- *Promote opportunities for stakeholders to leverage and share financial resources* - Does the scenario generate realtime or archival information that is marketable? Does the information sharing scenario make provisions for private sector participation?

- *Provide capital and operating funds in the TIP for ITS initiatives* - Are the capital and operating costs reasonable and supportable to justify TIP funding? How do the benefits of information sharing/incident management compare to other types of congestion management programs?

Analysis Summary

Given the above information concerning agency operations and requirements, after hours staffing, information sharing capabilities, costs, and the regional perspective, this section will conduct a through analysis of each scenario identifying their relative strengths and weaknesses.

Existing Scenario - During the operating agencies interviews it was apparent that the majority of the operation centers do not possess the technical expertise or equipment required to handle more advanced communications. Some have e-mail which they never utilize, others have not received sufficient training to operate the I-95 IEN, or inadequate staffing to handle additional responsibilities. Besides staffing and equipment problems, the current levels of information sharing is also reflective of the limited monitoring and response capabilities available in the region. However, even with this variety of problems, there was almost a universal recognition that the existing interagency communication protocols do not meet agency needs.

Information and decision making deficiencies identified by the agencies fall into two general categories. First, there is no overview of realtime regional traffic and incident conditions; the I-95 IEN is not sufficiently focused on the region, and many agencies expressed a desire for video feeds from other agencies. The second category of deficiencies were more institutional in nature: lack of local police involvement and no consistent, meaningful interaction among operation center staffs.

Except for NJDOT and PennDOT, all other operation centers provide 24 X 7 coverage. Both NJDOT and PennDOT have made arrangements for their staff to be notified of incidents after hours. Even with these provisions, several agencies felt this lack of full time coverage impaired their own operations.

Overall, this scenario performs an inadequate job in permitting the exchange of information and enabling cooperation. It provides a fair amount of incident information between traffic operation centers and emergency management centers, such as, NJ State Police or Philadelphia Highway Patrol but the main emphasis is on incident notification and to a lesser extent resource sharing. Similarly, there is excellent cooperation between transit management and emergency management personnel primarily because all transit agencies operate their own police departments and have developed working relationships with 911 services and local police departments. However, other than the DVHOGs fax list and the I-95 IEN, both of whom have limited coverage and are sparingly used, there is almost no consistent information sharing among traffic operation centers or with transit agencies. The DVHOGs and I-95 IEN are almost exclusively incident driven, and are not congestion oriented. Information on traffic conditions, delays, etc. will not be generally available until additional ITS monitoring equipment is deployed over the next 2-3 years. Most agencies

emphasize information dissemination to the media/traffic reporting services, but again the notifications are incident driven and follow-up information is inconsistent.

From a regional perspective, the weaknesses of this scenario far out number any advantages. The agency interviews revealed a far more substantial informal information sharing than many policy decision makers assumed. Since information sharing is largely informal, not all agencies are notified in a timely manner about incidents, few agencies share video feeds, and current road transit status information requires phone calls to individual agencies. There are no pre-arranged policies or procedures for interagency coordination during an incident. Because there is no long-term commitment for ITS coordination, the region is at a disadvantage in attracting federal money or private sector joint development initiatives.

Cooperative Scenario - At a slightly higher cost, this alternative delivers appreciable benefits over the existing scenario. It begins addressing many of the barriers blocking consistent flow of information and coordination among agencies. It could function as a low cost interim information sharing mechanism until the region employs the ITS equipment needed to support more the advanced scenarios. Without a substantial investment in money and personnel, however, this scenario can not fully address the long-term needs of the region.

From the agency perspective, the focus of this scenario is on upgrading information sharing procedures. Many agencies do not fully understand the information needs of other organizations, nor do they appreciate the constraints that others work under. Consequently, the outreach programs envisioned under the Cooperative Scenario will begin breaking down these barriers and initiate the development of more enhanced protocols, still informal, that are sensitive to agency needs and procedures. Ideally, the outreach programs and training sessions will not only encompass operation centers but also information service providers and some of the larger local police departments. New forms of communication such as digital phones, beepers, and e-mail will be experimented with to simplify the exchange of information. For example, e-mail, which requires a low level of technical expertise, could replace the IEN or fax list for regional notifications. This scenario does not provide for realtime overview traffic and incident information requested by the agencies.

Even if successful, this scenario will not fundamentally affect the type of information exchanged. Emphasis will still be on incident driven information, essentially increasing its consistency and

timeliness. Agencies not included or currently participating in the DVHOGs or the I-95 IEN will be incorporated into information sharing programs. Consequently some information flows that currently exist will be strengthened, while others that do not currently exist, for example between traffic operation centers and transit agencies, will be created. There will also be increased opportunities for individual agencies to strengthen information exchange among themselves, with video sharing as an example. Even with these improvements, many critical categories of information, such as traffic data, congestion data or road conditions, will still not be exchanged in an acceptable manner. This deficiency eliminates this scenario as an acceptable long-term solution.

From a regional perspective, the Cooperative Scenario establishes a long-term commitment to ITS planning including development of ITS vision and priorities. At a minimum cost, it will establish a framework that will provide a higher degree of information sharing than current conditions, but still is not commensurate with regional needs. It does not address 24 X 7 operations nor does it establish pre-arranged policies or procedures for interagency coordination during an incident. The region would still lack an information clearinghouse for real time transportation/incident information to facilitate more advanced traveler information programs or attract private sector joint development projects.

In terms of cost, the annual cost of $400,000 is fairly modest when compared to the more advanced scenarios which cost millions to implement and operate. Since it does not require a significant capital cost investment, this scenario could serve as a interim phase while more advanced scenarios which better serve regional needs are developed and implemented.

Decentralized Scenario - This scenario establishes a more structured mechanism to share information. Under it, a wider array of information, not just incident driven data, will be displayed on simplified based maps in a similar manner to the I-95 IEN. This information will foster a stronger decision making process by providing operation center staffs with an overview of current conditions. While this scenario does not fulfill all the agency needs, it comes closest to meeting the goals of this study, among the moderate cost alternatives.

Many agencies currently either use or are familiar with the I-95 IEN. Consequently, a localized version will not dramatically impact their operations. The proposed modifications address what many agencies perceive are the I-95 IEN's deficiencies such as insufficient local detail, a primary focus on problems in the New York or Washington metropolitan areas, and lack of clear benefits

to local agencies. Addressing these deficiencies should result in a greater acceptance by local staffs, thus insuring more active use of the IEN. Implementing a regional IEN will also foster a greater degree of cooperation among operating agency staffs. The response, management and clearance of most accident situations, including frequent closures on the Schuylkill Expressway, become routine after a while. As such there is already substantial, but informal, cooperation among agencies. Development of regional protocols will formalize these relationships and address the weakest links. Therefore, the information generated by the IEN coupled with regional protocols and greater staff interactions will lead to improved decision making.

The IEN approach does have many serious shortcomings. It focuses on incident notification and lacks the larger overview of basic traffic conditions. For example, if traffic is detoured onto an highway the operations center may know from the IEN that there is no construction activity, however information pertaining to traffic congestion will not be available. It does not provide interactive graphics nor does it address the lack of local police cooperation. It also does not address communications difficulties with Amtrak. Since input into the IEN is a manual process, SEPTA staff can use its own judgement as to which incidents to post. This scenario does not address state police needs. To minimize notification time, notifying the police about an incident on facilities under their jurisdiction will still primarily flow directly from county 911 services or PennDOT. Again, since information about incidents outside their jurisdiction is of little use to them, their willingness to participate in such a program is limited. Agency interviews indicate training will be the key to its use.

The Decentralized Scenario begins to address the issue of after hours coverage. Staff presence is required to manually input information into the IEN. If the issue of continuous staffing is not achieved through other means, the rationale for implementing an IEN system is partially defeated.

New information flows include: more congestion information, VMS/HAR status and incident response status (duration, road closures, etc.),

A modest number of benefits accrue from the concept of various agencies jointly implementing a regional project. Primarily, the proven ability to develop and implement a vision can lead, in the future, to other regional initiatives. With the IEN, agencies will begin to have the ability to 1) develop and implement pre-arranged incident management policies or procedures for interagency coordination, 2) improve project level coordination among agencies and 3) enhance their ability

to develop public/private initiatives. While information on unusual conditions will be available for major incidents/facilities, this scenario does not provide an information clearinghouse for real time transportation/incident information about secondary incidents/roads. The effectiveness of information sharing is dependent upon the agencies' willingness to work together and follow common procedures. Implementation of this scenario will requires an MOU for the coordination framework and the designation of a lead agency to contract the development and maintenance activities for an information exchange network.

Interactive Database Scenario - This scenario fully addresses District 6-0 needs by providing graphical mapping, a shared database of travel conditions, and video feeds from other agencies CCTV cameras. The conversion of PennDOT's traffic condition data into the regional database would be accomplished through this scenario. Training courses and review meetings will foster improved familiarity of each others needs and constraints.

For NJ DOT, this scenario addresses most of their needs by creating a more focused local IEN network with interactive graphics and availability of video feeds from other agencies. It also establishes regional protocols, however, it does not address the problem of obtaining information from local police forces.

This scenario addresses many of SEPTA's needs. The database would enable SEPTA to take advantage of the advanced technology to obtain information from Amtrak's CTEC, video images from PennDOT, and to share bus travel speeds generated by AVL with other agencies. A critical element of insuring the database's integration with SEPTA operations is the ability to screen out congestion/incident information not applicable to SEPTA while providing useful information on travel conditions on bus routes.

PA State Police: This scenario has the same limitations for the State Police as the Decentralized Scenario and the additional data it provides is not applicable to the state police.

Centralized Scenario

Like the Decentralized Scenario, this scenario focuses on incident notification and updates on VMS or incident status. Centralized staff will provide the "big picture" which would be provided by the graphical interface and backup database under the Interactive Database Scenario. This scenario shifts the responsibility of monitoring the "big picture" from an individual agency to a centralized

staff. Implicit in this scenario is that the stakeholders can create a central coordinator of travel condition information which does not assume operations or control over the agencies facilities or equipment. Based upon observation of PennDOT's functionality, it does not appear that having a regional coordinator is critical in PennDOT's operations.

For NJ DOT, this scenario indirectly establishes a local IEN through a centralized screening and information sharing process. However, a regional traffic/incident database would not be available at NJ DOT, so they would have to contact the new central organization to obtain information about a particular facility. Video feeds would not generally be available unless agencies made special arrangements among themselves. This scenario does begin to address NJ DOT's issue with local police departments issues by providing one centralized telephone number for information sharing.

This scenario could address SEPTA's needs if it is augmented with live video feeds. A centralized staff can screen incident information to determine which ones are applicable to SEPTA's bus routes. Similarly, SEPTA personnel can manually decide which incidents on their system should be disclosed to other agencies. Video feeds from PennDOT would have to be obtained through a separate agreement. A major short coming is that this scenario does not equip SEPTA with a direct feed from AMTRAK's CTEC.

Of the more technologically advanced coordination scenarios, this may be the most compatible with PA State Police operations.

Regional Operations Center

In many ways, from a regional perspective, this scenario is similar to the Centralized Scenario. This scenario offers many positives including a single point of contact, the ability to develop and implement incident management plans, and the establishment of a central clearinghouse for disseminating transportation information to the public and reducing the burden on operating agencies. Establishing a formal structure for operations maximizes coordination among participating agencies, enhances the ability to attract additional federal money or private sector partnerships, particularly those utilizing a centralized database. In terms of weaknesses, institutional issues and high start-up and operating costs limit the usefulness of this scenario. It would be very difficult to obtain an agreement to implement or even manage a regional operations center. With PennDOT and SEPTA completing new operation centers and NJDOT and DRPA beginning the planning processes for theirs, the region can not afford losing the previous

investments. Determining equitable cost allocation among participating agencies, liability issues, and defining central staff/agency level responsibilities are just some of the issues which would need to be resolved before this scenario could be successfully implemented.

It appears that this scenario meets operating agency needs by co-locating the agencies in one operation center, thus maximizing interagency information sharing and decision making. From the agency perspective, however, this concept may be overkill in terms of interagency coordination. As previously documented many agency concerns and geographic areas do not overlap. For example, DRPA needs to coordinate with NJDOT, PennDOT, and the City of Philadelphia. Historically there has been minimal need to interact with other agencies such as Pennsylvania State Police or SEPTA. This situation can be applied to almost all other agencies. Consequently there is almost no justification to relocate all agencies. In some instances, such as with PennDOT and the Pennsylvania State Police, a joint operation center may be warranted and needs to be examined by the agencies on a case by case basis. In addition to placing too many agencies under one roof, municipal police, one of the key players, would still be missing. In addition, most incidents do not escalate to the level requiring a regional operations center. Therefore, this type of facility is not warranted.

IV. FINDINGS AND RECOMMENDATIONS

ITS Technical Task Force Findings and Consensus

This chapter presents those issues that the TTF found to be instrumental in the development of the final recommendations. After reviewing the initial institutional coordination scenarios presented by DVRPC staff, the TTF developed a concept which took elements of several scenarios and tailored the concept to address the issues that were important to the Delaware Valley. Those issues are presented below.

The TTF recognized that the key stakeholders were at various stages of implementing their own ITS programs and had not typically been interacting with most of the other stakeholders. Even those agencies that were implementing ITS technologies were in the early stages of their programs and still learning how best to integrate these resources into their own operations. The feeling of the TTF was that the agencies should "walk together before they run"; meaning start slowly and proceed in a planned and controlled manner. "Together" meant that for a regional program to be successful agencies should coordinate their efforts and begin by building operational relationships with each other. Continued monthly meetings of the TTF and/or other groups helps to share information on their respective programs and promotes coordination among the stakeholders. At a minimum, this relationship building puts a face with a name and allows the stakeholders to interact on a personal level. The TTF also felt that a planned controlled approach would allow the agencies to transition the deployment of technologies and prevent them from jumping into this emerging field too quickly. This transitioning also allows the agencies to keep their initial capital investments low.

An issue that the TTF felt particularly strong about was that when developing an institutional coordination structure, the region should avoid creating a new entity or bureaucracy to control/manage information sharing, traffic management or oversight of ITS deployment. The TTF also found the region's 24 x 7 capabilities inadequate. The region's two largest stakeholders do not operate their control centers around the clock. Although both PennDOT and NJ DOT have procedures in place to contact control center staff after hours, their control centers are closed down and equipment such as CCTV cameras are typically turned off overnight and on weekends. The TTF felt it was important to have as many stakeholders as possible monitoring their facilities around the clock.

While it is inherent in transit agencies to have a commitment to operate their systems, highway agencies traditionally built and maintained their facilities. The concept of operations is a new phenomenon for agencies such as PennDOT and NJ DOT and the concept of coordinating the operations of their facilities/systems with others is new for most agencies. Therefore, to effectively institute procedures for coordination among agencies, a new way of doing business and new mind set must permeate these organizations. The TTF felt that a commitment from the agencies' policy level staff is required to actively promote interagency coordination at the operations level. Without this directive from an organization's leadership, their staff will not seek to build working relationships with other organizations on their own. Working relationships among organizations' operational staffs is critical to effective interagency coordination. The TTF felt that this coordination and sharing of information among operations personnel will serve as the foundation for information sharing to public.

The TTF felt that public agencies are best prepared to collect and analyze the travel data from their facilities/systems, but the private sector is better positioned to package and disseminate this information to the public. The TTF felt that the agencies should continue to promote dissemination of travel information to the public through existing partnerships and resources shared with the private sector.

Lastly and most importantly, the TTF advocated the implementation of an institutional coordination concept referred to as Philadelphia Regional Integrated Multimodal Information Sharing (PRIMIS). This concept is recommended to be implemented in a phased approach which is described below.

PRIMIS Phase I

This phase closely resembles the Cooperative Scenario. During this phase, activities to enhance the existing relationships among the region's stakeholders and build new relationships will be conducted. Primarily, the Coordinating Council and the Technical Task Force will become a formal Regional ITS Committees under DVRPC's committee structure. This will integrate the committees with DVRPC's planning and funding functions. In addition to the DVRPC committee, the stakeholders will work more closely with the DVHOGs.

Phase I will make modest changes to the current procedures by complimenting the current activities with some additional outreach programs that encourage the region's agencies to share information

on travel conditions. Specifically, the TTF, in conjunction with the DVHOGs, will sponsor training courses, expand and update their contact list, develop a fax and pager list, monitor and evaluate the success of this phase and develop a concept of operations for Phase II.

This phase applies a proactive approach to improving the information flow between agencies. The end result will be the implementation of new low-cost, "low-tech" approaches to improve communication. The development of additional information and contacts will also benefit the DVHOGs and allow them to expand their interagency communication.

Significant changes in the way travel information is disseminated to the public is not envisioned during this phase. The individual agencies will continue to disseminate travel information to the public through their own methods including forming partnerships with private sector organizations. Since the intent of this phase is to build operational relationships and share information among the agencies, little emphasis will be put on developing a regional, comprehensive source of real-time travel information available for public access.

No new procedures are envisioned which would change the existing procedures that the organizations have in place to provide coverage of their facilities after hours. Individual organizations may decide on their own to change the times that their operation/control centers are open but there will be no new technology or policy developed as a result of activities undertaken in this phase to address after hours coverage.

PRIMIS Phase II

The second phase of the PRIMIS concept essentially implements the Decentralized Scenario. The purpose of this scenario is to facilitate communications, including information sharing and limited operations coordination among regional stakeholders through enhanced technology. This concept is expected to utilize the I-95 IEN focused on the Delaware Valley. It would serve as the technological backbone of the communication with the intent to increase the number of agencies which currently have access to an IEN workstation.

The Regional ITS Committee, functioning under DVRPC's committee structure, will continue to guide this process and be the focal point of institutional coordination of ITS activities. It is envisioned that this committee would coordinate with the I-95 Corridor Coalition for the enhancement and integration of the IEN into the stakeholders' operations. The participating

organizations would be expected to enter into a memorandum of understanding to set forth the agreed upon procedures for the implementation and operation of the focused IEN. The Regional ITS Committee and a contractor will assist the stakeholders to develop procedures and protocols which identify when specific organizations should be notified about an incident, what type of information is shared through the IEN and how frequently it is updated. A contractor will also assist in the development of a database to house all the pertinent information and also assist in the development of upgraded mapping needed to display the additional transportation facilities focused on the Delaware Valley.

This phase will require significant change for many organizations in the way they share information both internally and with other organizations. The Regional ITS Committee will sponsor training courses for the participating organizations in the operation of the IEN. A commitment from these organizations' top management is necessary to assure that their personnel attend this training and integrate the IEN into their primary operations.

During this phase, the coordination of operations will be greatly enhanced through the expanded use of the IEN. With the development of a procedures manual, organizations will know what resources other organizations would be willing to share (VMS, HAR, personnel, etc.) in the case of an incident.

Use of the IEN will enhance the after hours coverage capabilities for all stakeholders. Even those organizations which do not operate their workstations 24 x 7 may have agreements with other organizations to notify their staff at home when an incident occurs that may effect their facilities. An organization without 24 x 7 coverage may allow another organization access to their VMS or HAR through the IEN and post approved messages about incidents.

No significant changes in the way travel information is disseminated to the public is envisioned during this phase. The individual agencies will continue to disseminate travel information to the public through their own methods including forming partnerships with private sector organizations. However the quality and timeliness of the information is expected to be greatly enhanced because of the consistency of the message shared through the IEN.

PRIMIS Phase III

If the region's ITS stakeholders decide that PRIMIS II does not meet all their needs, a third phase of this concept will be implemented. Phase III would be an implementation of the Interactive Database Scenario and represent an enhancement over the I-95 IEN by incorporating a real-time database and graphical user interface to view real-time congestion levels, incident information, and VMS/HAR status on the transportation network as well as the ability to share real-time full action video feeds. Besides data sharing, the virtual private network will provide a mechanism for operating agencies to confidentially share information and request assistance from each other through coordinated operations.

The Regional ITS Committee, functioning under DVRPC's committee structure, will continue to guide this process and be the focal point of institutional coordination of ITS activities. This concept will necessitate developing an MOU among cooperating agencies to establish an Information Sharing/Operations Subcommittee, delineate agency roles and responsibilities, contracting procedures, and a cost allocation formula for sharing capital and operating costs.

As with the previous two phases, training is a critical element in ensuring the success of this concept, therefore, continuing training opportunities will be made available to familiarize operation center personnel with the system. A contractor will assist in the development of a database and also assist in the development of a graphical user interface

The initial emphasis of this phase will be to facilitate enhanced center to center communication ultimately encompassing highway agencies, transit operators, toll authorities, county 911 operations, selected municipal emergency response agencies and adjoining metropolitan areas and states. However, portions of the database will eventually be available to the media and other authorized information service providers. It is anticipated that private companies subscribing to the database will reformat the data for customized travel information services. Ultimately, the cooperating agencies may permit some database elements such as video images to be posted on the internet.

Those stakeholders which operate their control centers on a 24 x 7 basis will have 24 hour access to the Interactive Database. If all agencies do not operate 24 x 7, some elements of the Interactive Database may not be available, diminishing the overall quality of information available after hours. If arrangements are worked out among agencies, the Interactive Database can support coverage of

facilities whose operation centers are closed by permitting an open center to monitor highways through video streaming and utilizing available detectors.

Staffing

Phase I would not require the individual stakeholders to hire any additional staff. Staff support to the Regional ITS Committee would be provided by DVRPC. Staff would also maintain any updates to the Regional ITS Architecture and coordinate the outreach programs.

During Phase II, the stakeholders may need to dedicate staff time to meeting participation and training. Some agency operating procedures may have to be modified and some of their staff may have to carry beepers/cellular phones to receive messages. Additional staff may needed by those agencies not currently operating an IEN workstation or by those agencies expanding their control center's hours of operation. Regional ITS Committee and subcommittee staff support could be provided by existing DVRPC staff.

Consultants would need to be hired to develop a database for the new IEN and procedures (with a manual) for the operations of the network, integrate network into existing operational procedures, develop cost allocations for each stakeholder's participation, provide system maintenance, and develop training programs.

Establishment and operation of the Interactive Database in Phase III will require substantial initial involvement by operating agency personnel. Agency staff need to be actively involved in consultant selection and supervision to insure the Interactive Database meets their needs. While no additional staffing is envisioned to operate the system, some committee members may be so involved with the design and management of the Interactive Database that some of their other responsibilities may have to be assigned to other staff or additional personnel may be needed. Stakeholder personnel will also have to attend training courses to properly operate the system.

Staging

Each phase builds upon the successes of the previous phase. Because of the transitioning of the technology, there will be no obligation to move on to the next phase. The concept advances only after a positive evaluation during the current phase. Phase I can begin immediately and should last a minimum of two years. It is envisioned that before the end of year three the stakeholders should move into a second phase. Phase II could begin in year two and potentially last into year seven.

However, as this phase progresses, continual evaluation is recommended to determine if this concept and technology is sufficient to meet the needs of the stakeholders and the region's travelers. It is expected that the region's stakeholders would wait until at least year 5 before they decide to move onto a subsequent phase. This timeline would allow them to see how Phases I and II develop.

Capital Costs

There are no capital costs associated with the implementation of Phase I. It would not require any direct cost to the individual stakeholders other than meeting participation. During Phase II, a capital cost of approximately $3.2 million is estimated to be required to develop a Delaware Valley Information Exchange Network as part of the I-95 IEN. This includes the purchase and installation of workstations for the participating organizations, the purchase and installation a web server, development of regional mapping and continued training courses. This cost estimate assumes that 20 Tier I and Tier II organizations will be the initial participants. Because of the technological enhancements of Phase III, a capital cost of $20 million is estimated for the 10 Tier I organizations. Some of the primary elements that make up this cost estimate include: development of system software, server(s) and communications hardware, leased fiber optics, interactive mapping and continued system training for the operators from the participating organizations. The cost estimates for Phases II and III can vary significantly depending on the number of participating organizations and a possible reduction in the cost of technology at the time of implementation.

Operations and Maintenance Costs

The administrative costs for Phase I such as conducting training, facilitating and hosting the regional ITS forum and maintaining the regional architecture would be approximately $400,000 per year. An annual cost of approximately $1.2 million is estimated for Phase II. This would be used for communications interface, upgrades to hardware and mapping, continued training and other administrative costs. During Phase III , an annual cost of $7 million is estimated to cover hardware and software upgrades, leased fiber and training. It is important to keep in mind that, again, the costs estimates for Phases II and III can vary significantly depending on the number of participating organizations and a possible reduction in the cost of technology at the time of implementation.

Funding

It is recommended that the administrative costs for Phase I and the capital costs for Phases II and III be funded through the TIP. Costs to operate and maintain the systems developed in Phases II and III should be funded by the individual stakeholders participating in PRIMIS.

Implementation Steps

The following actions items are recommended for the implementation this PRIMIS concept:

- ✓ Obtain endorsement of the three-phased PRIMIS concept from the ITS Coordinating Council;
- ✓ Forward the endorsement to the DVRPC Board and request the establishment of a Regional ITS Committee as part of the DVRPC committee structure;
- ✓ Obtain commitment from the stakeholders to designate staff to the Regional ITS Committee;
- ✓ Obtain funding in the DVRPC FY 2001 - FY 2004 Transportation Improvement Program;
- ✓ Educate stakeholders on the implementation and operations of PRIMIS concept through presentations to their upper level management; and,
- ✓ As agencies implement operations centers and ITS projects, they should integrate them with the PRIMIS concept.

APPENDIX A

DELAWARE VALLEY ITS COORDINATING COUNCIL

AMTRAK
Community Transit
County of Bucks
County of Burlington
County of Camden
County of Chester
County of Delaware
County of Gloucester
County of Mercer
County of Montgomery
Delaware DOT
Delaware River Port Authority
Delaware River Joint Toll Bridge Commission
Delaware Valley Regional Planning Commission*****
Federal Highway Administration - PA
Federal Highway Administration - NJ
Federal Transit Administration
New Jersey Department of Transportation
New Jersey State Police
New Jersey Transit
New Jersey Turnpike Authority
Port Authority Transit Corporation
Pennsylvania Department of Transportation Central Office *****
Pennsylvania Department of Transportation District 6-0
Pennsylvania State Police
Pennsylvania Turnpike Commission
Philadelphia - Mayors Office of Transportation
Philadelphia Streets Department
Philadelphia Police Department
Philadelphia Fire Department
Philadelphia Parking Authority
Southeastern Pennsylvania Transportation Authority
SmartRoute Systems
South Jersey Transportation Authority
TRANSCOM

*** Council Co-Chairs**

APPENDIX B

DELAWARE VALLEY ITS TECHNICAL TASK FORCE MEMBERSHIP

AAA - Mid Atlantic Region
AMTRAK
Burlington County Engineers Office
Burlington County Bridge Commission
Community Transit
Delaware County Planning Department
Delaware River Joint Toll Bridge Commission
Delaware River Port Authority
Delaware Valley Regional Planning Commission
FHWA - New Jersey
Drexel Univ. - Intelligent Infrastructure Institute
FHWA - Philadelphia Metro Office
Greater Valley Forge TMA
Montgomery County Planning Commission
New Jersey DOT
New Jersey DOT Traffic Operations South
New Jersey State Police
New Jersey Turnpike Authority
New Jersey Transit
Port Authority Transit Corporation
Pennsylvania DOT Central Office
Pennsylvania DOT - District 6-0
Pennsylvania State Police
Pennsylvania Turnpike Commission
Philadelphia - Mayor's Office of Transportation
Philadelphia Fire Department
Philadelphia International Airport
Philadelphia Police Department
Philadelphia Streets Dept./Traffic Engineering
SmartRoute Systems
Southeastern Pennsylvania Transportation Authority
South Jersey Transportation Authority
TRANSCOM

APPENDIX C

AGENCY COORDINATION HIERARCHY

TIER I

Delaware River Port Authority (DRPA)

New Jersey Department of Transportation (NJDOT) Traffic Operations South

New Jersey State Police

Pennsylvania Department of Transportation (PennDOT) Operations Center, District 6-0

Pennsylvania State Police

Philadelphia Police Department (Highway and Traffic Divisions, 911 Services)

Philadelphia Streets Department

Port Authority Transit Corporation (PATCO)

SmarTraveler

Southeastern Pennsylvania Transportation Authority (SEPTA)

TIER II

AMTRAK

Delaware Department of Transportation (DelDOT)

Delaware River and Bay Authority (DRBA)

Delaware Turnpike Authority

Express Traffic / Metro Traffic

New Jersey County 911 Systems (Burlington, Camden, Gloucester, Mercer)

New Jersey Transit

New Jersey Turnpike Authority

Pennsylvania County 911 Systems (Bucks, Chester, Delaware, Montgomery)

Pennsylvania Turnpike Commission (PTC)

Philadelphia International Airport

South Jersey Transportation Authority (SJTA)

TRANSCOM

TIER III

AAA

Burlington County

Burlington County Bridge Commission

County Paratransit Operators (e.g., Community Transit)

Delaware River Joint Toll Bridge Commission (DRJTBC)

Delaware Valley Regional Planning Commission (DVRPC)

Drexel Infrastructure Institute

Media: TV / Radio Stations / Newspapers

Municipal Police / Fire Departments

New Jersey Emergency Management

Pennsylvania Emergency Management

Philadelphia Center City District

Philadelphia Convention and Visitor Bureau

Philadelphia Industrial Development Corporation (Sports Complex)

Philadelphia Parking Authority

Transportation Management Associations (Bucks Co., Delaware Co., Chester Co., Greater Valley Forge, Partnership, Cross County Connection, Mercer)

Other Private Sector Companies To Be Determined

APPENDIX D

DELAWARE VALLEY HIGHWAY OPERATIONS GROUP NOTIFICATION LIST

Agency	Name	Location
Delaware DOT	Desk Sergeant	SR 1 Station - Dover
Delaware DOT	Robert Burge	DelDOT TMC
Delaware River & Bay Auth.	Police Comm. Center	Delaware Memorial Bridge
Delaware River Port Authority	Shift Supervisor	Ben Franklin Bridge
Delaware State Police	Shift Supervisor	HQ Comm. Center
Delaware Turnpike	Toll Sergeant	I-95 & DE/MD State Line
I-95 NEC		
New Jersey DOT- South	Shift Supervisor	Traffic Ops. South- Mt. Laurel
New Jersey State Police	Duty Officer	Operational Dispatch Unit
New Jersey Turnpike	Shift Supervisor	New Brunswick TOC
Pennsylvania DOT	Karl Ziemer	PennDOT-TCC - King of Prussia
Pennsylvania State Police - Media	Shift Supervisor	Media Barracks
Pennsylvania State Police - Trevose	Shift Supervisor	Trevose Barracks
Pennsylvania Turnpike	John A. Boschi	Highspire, PA
Philadelphia Police Dept.	Comm/Ops Desk	Police Admin. Building
South Jersey Transportation Auth.	Shift Supervisor	AC Expressway Station
TRANSCOM		Operations Info Center

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ABSTRACT
This document presents a set of recommendations for institutional coordination of Intelligent Transportation Systems (ITS) and regional travel information sharing. These recommendations were developed through a coordinated effort by DVRPC with significant input from the Delaware Valley ITS Coordinating Council and the Delaware Valley ITS Technical Task Force. The recommendations are presented in a three-phase approach identified as Philadelphia Regional Integrated Multi-modal Information Sharing (PRIMIS). The staging, staffing, costs and implementation steps are presented in this document for each phase.

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