Regional Integrated Multi-Modal Information Sharing (RIMIS) System Project
Concept of Operations

Delaware Valley Regional Planning Commission
190 North Independence Mall West
Philadelphia, Pennsylvania
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1.0 CONOPS OVERVIEW

This Concept of Operations (CONOPS) is a document that will communicate the need for the Regional Integrated Multi-Modal Information-Sharing System (RIMIS). RIMIS is a system whose ultimate goal is to improve the management of the Delaware Valley’s transportation infrastructure through an improved communication infrastructure. The document discusses the needs identified in the CONOPS from both an operational perspective and a systems design and requirements perspective. The outline of this CONOPS conforms to guidelines set forth by the Institute of Electrical and Electronics Engineers, Inc. (IEEE) in Standard 1362-1998 (IEEE Guide for Information Technology – System Definition – Concept of Operations (ConOps) Document).

The remaining sections of this CONOPS are identified and briefly discussed as follows:

Section 3 describes the “As Is” model, or current situation, under which the agencies in the Delaware Valley operate. This description includes the current communication context, operational policies and constraints, and the motivations and scope of RIMIS. Section 3 also identifies and justifies the desired features for RIMIS and identifies its users in accordance with major identifiable groups or classes.

Section 4 identifies the justification for RIMIS in light of the current “As Is” model. It discusses the nature of the system in terms of system capabilities. This section of the CONOPS also ranks these capabilities according to user needs. Features that were considered but excluded are also considered.

Section 5 discusses the concept for the proposed system. Included in this section are the background, objectives, and scope for RIMIS, as well as related potential policy and operational constraints. The section also discusses more technical aspects of the system, such as the RIMIS architecture, data standards, archiving requirements, and messaging model.

Section 6 identifies RIMIS operational scenarios. This includes a walkthrough of a simulated scenario in which the user interacts with a potential design for the graphical user interface (GUI).

Section 7 discusses the impact of RIMIS on potential users. The focus for this discussion is on the operational impacts to RIMIS users based on their general job categories/classifications. Additional topics include general impacts on Human Resources, budget, and programming, as well as impacts to the agencies during development.

Section 8 summarizes the capabilities and benefits of the new system and discusses its potential disadvantages and limitations.
2.0 REFERENCED DOCUMENTS


Joint Committee on the NTCIP, *The NTCIP Guide: An Updated Version 3 of NTCIP 9001: National Transportation Communications for ITS Protocol (V 03.02)*, October 2002.

3.0 CURRENT SITUATION

The Delaware Valley region supports substantial residential and employment populations (i.e., more than 5 million and 3 million people, respectively) who are served by an extensive intermodal transportation network consisting of expressways and toll facilities, key arterial highways, light and heavy rail lines, and express and local bus routes. Key nodes of the transportation network include a large sports and entertainment facility complex in South Philadelphia, the Philadelphia International Airport, 30th Street Station, and major freight terminals. The major bridges crossing the Delaware River in the region are among the key "links" on this network.

Each day people use the regional transportation network to get to and from work, school, recreational locations, medical services, shopping sites, and other locations. They share the network with commercial and industrial transporters of goods, bulk materials, and other commodities. Regional and local traffic and commuter services share some of the same transportation facilities on the network with long-distance, inter-regional highway, and rail traffic. This combined network demand causes traffic congestion and delays on a regular basis, particularly during peak periods for weekday home-work/work-home commutes, and directly before and after scheduled special events. Moreover, the effects of the use of the Delaware Valley’s regional transportation network do not recognize regional Metropolitan Planning Organization (MPO) boundaries. In this environment, the impact of emergency events and incidents are magnified, and the effects propagate rapidly throughout the network. At the same time, events and conditions that exist across the broader region affect the Delaware Valley transportation network.
3.1  **CURRENT TRANSPORTATION MANAGEMENT AND COMMUNICATIONS CONTEXT**

In this complex regional transportation environment, transportation management responsibilities fall on an extensive mosaic of agencies and institutions; however, traffic and emergency management communication roles throughout the entire region are not centralized. Several jurisdictional boundaries prevail among the major transportation managers, service providers, and other RIMIS stakeholders. The region has established trusted operational relationships and methods of inter-agency communications. RIMIS stakeholders agree that meeting the current and future transportation management and public safety challenges of the region will require timely, concerted, and coordinated efforts by a great number of agencies, including:

- Three state Departments of Transportation
- Philadelphia Streets Department
- County public works agencies
- Five major transit agencies operating bus and rail services
- Four authorities operating Delaware River bridges
- Four turnpike authorities
- Three state police forces
- Philadelphia police and fire departments
- County 911 and local fire, police, and EMS responders
- Traffic reporting services and multiple county and sub-regional transportation management associations (TMAs).

The Agency Functions and Operations matrix shown in Table 3-1 is based largely on the needs and constraints report. The table helps clarify the range of operations of the major RIMIS agencies by showing which functions are performed in the respective operation centers.

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1 A growing trend is to centralize communication/coordination capabilities in some parts of the country. Previous communications coordination and information dissemination effort, such as the RIMIS e-mail listserve and the I-95 Corridor Coalition’s Information Exchange Network (IEN) web-based system, have been introduced to this context but with limited success.
### Table 3-1. Agency Functions and Operations

<table>
<thead>
<tr>
<th>Agency</th>
<th>Primary Focus</th>
<th>Control Center</th>
<th>Transportation Functions</th>
<th>Traveler Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Monitor Traffic Conditions</td>
<td>Transit Command / Control</td>
<td>Dispatch Emergency Service Patrol Vehicles</td>
</tr>
<tr>
<td>Burlington County Bridge Commission</td>
<td>Toll Bridges</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>County / Municipal Traffic Operation Centers</td>
<td>Street System</td>
<td>E / F</td>
<td>F</td>
<td>E</td>
</tr>
<tr>
<td>DE DOT</td>
<td>Expressways / Arterials / Interstates</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Delaware River and Bay Authority</td>
<td>Toll Bridges</td>
<td>E</td>
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<tr>
<td>Delaware River Joint Toll Bridge Commission</td>
<td>Toll / Non-Toll Bridges</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Delaware River Port Authority</td>
<td>Toll Bridges</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<tr>
<td>New Jersey Turnpike Authority</td>
<td>Toll Facility</td>
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<td>E</td>
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<tr>
<td>NJDOT Traffic Operations South</td>
<td>Expressways / Arterials</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Pennsylvania Turnpike Commission</td>
<td>Toll Facility</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>PennDOT District 6-9</td>
<td>Expressways / Arterials</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Philadelphia Sports Complex</td>
<td>Sports Complex</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Philadelphia Streets Department</td>
<td>Street System</td>
<td>F</td>
<td>F</td>
<td>F</td>
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<tr>
<td>South Jersey Transportation Authority</td>
<td>Toll Facility</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<tr>
<td>PATCO</td>
<td>Rail Operations</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>SEPTA</td>
<td>Bus / Rail Operations</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<tr>
<td>New Jersey State Police</td>
<td>Law Enforcement</td>
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<td>Pennsylvania State Police</td>
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<td>Philadelphia Police Department</td>
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<td>Philadelphia Fire Department</td>
<td>Emergency Responder</td>
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<tr>
<td>Local Police / Fire</td>
<td>Emergency Responder</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<td>County 911s</td>
<td>E-911 Operator / OEM</td>
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<td>E</td>
<td>E</td>
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<tr>
<td>Traffic Reporting Services</td>
<td>Information Service Provider</td>
<td>E</td>
<td>E</td>
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<tr>
<td>Transportation Management Associations (TMAs)</td>
<td>Information Service Provider</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<tr>
<td>I-95 Control Center IPN</td>
<td>Information Exchange Network</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>TRANS.COM</td>
<td>Information Exchange Network</td>
<td>E</td>
<td>E</td>
<td>E</td>
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* E = Existing
* F = Future
* " = NJDOT Maintenance Dispatch is co-located with NISP Dispatch Center
* = NJ State Police are co-located in NJDOT Operation Center
*** = PennDOT Maintenance Dispatch is performed at individual County Maintenance Offices
**** = NJ Transit Police Dispatch is centralized in Maplewood, NJ
Regional agencies responsible for the safety, efficient operation, and management of the transportation network have expressed the need for reliable inter-agency information sharing and coordination via enhanced communication technology. This need is mainly the result of the transportation network having reached and exceeded its capacity at many times and locations. Another major influence on the current need is the evolution of inter-agency and multi-party transportation management communications as individual agencies in the Delaware Valley have invested in new technologies and approaches to enhance their own operational practices.

Currently, inter-agency communications in the region are a combination of landline and wireless connections over both owned and public network facilities that use multiple channels and frequencies, depending on the resources available to each agency. These features give the current regional transportation management communications network a “many-to-many” structure. In this context, inter-agency communication related to transportation management on the regional network typically occurs as exclusive, center-to-center (C2C) or agency-to-agency communication. Under these conditions, the existing fragmented inter-agency communications are not effective enough when the regional transportation network is stressed by a major incident, for example, that requires the involvement of a large number of agencies.

The region receives traveler information from several sources. Agencies provide traveler information by using at varying degrees the Internet to display construction activity, CCTV video, and weather conditions. An all-news radio station (KYW 1060) regularly broadcasts traffic and transit conditions. Other radio and television stations broadcast traffic conditions during peak weekday hours. The Southeastern Pennsylvania Transportation Authority (SEPTA), the region’s largest public transportation provider, publishes rail system status, pre-planned and weather-related detours, and diversions information on its website. Traffic.com and Westwood One services offer interactive information via their websites for the Philadelphia region and provide traveler information to local TV news programs and radio stations.

Many agencies in the region are involved with programs to provide additional uniform traveler information-sharing services that enable anyone to dial 511 on a telephone to directly acquire traffic and incident management, public transportation, and weather information. Implementation of 511 is being undertaken on a statewide basis, and so far no coordination efforts among the three states in the region has taken place. Some portions of the transportation network have variable message signs (VMS) deployed to provide en-route warnings and other information.

Today, most of the inter-agency transportation management communications in the Delaware Valley are via telephone service, with some use of e-mail, fax, radio, Nextel phones, and Internet resources. As stated earlier, the one-to-one communication is the form usually used within an overall structure that has grown with only a limited capability to broadcast information simultaneously to a large number of agencies. Situational data (e.g., video information) are generally relayed via voice communications or, in some cases, via Internet access to video resources. E-mail and Internet communications are generally not integrated into agencies’ normal transportation management systems. The radio communication systems of the regional agencies operate on various channels and technologies and cannot be depended on for widespread communications. The I-95 Corridor Information Exchange Network (IEN) is available in the transportation management facilities of some agencies, but it operates on a separate, dedicated platform and is generally under-used.

At present, the Delaware Valley Highway Operations Group (DVHOG) uses a fax list to send incident information between members. The effectiveness of this system is limited by a restricted subscriber list, and facsimile transmissions are not dependable when message exchange is needed. Planned roadway maintenance and construction activities are also shared periodically between some agencies via faxed transmissions, but they do not reflect real-time situations on the street.

Operation of traffic management centers has been an issue in coordinating regional traffic management. Many traffic operation centers are not staffed 24x7. In April 2005, the Pennsylvania Department of Transportation (PennDOT) became the last existing regional traffic management center to operate on a 24x7 basis. Two other important agencies, the Delaware River Port Authority (DRPA) and the City of Philadelphia Streets Department, currently do not have operation centers. Incident notifications or
information requests during off hours may generate no immediate response or, at best, a delayed response.

Table 3-2 shows a matrix describing transportation agency interactions with other stakeholders. The description includes existing types of interactions that currently occur and the interactions that agencies desire to occur.

Table 3-2 Transportation Agency Interaction with Other Stakeholders

<table>
<thead>
<tr>
<th>Inter-agency Capabilities</th>
<th>Characterization of Current Situation</th>
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<tbody>
<tr>
<td>Methods</td>
<td>Telephone landline (most common medium) Wireless and wireless push-to-talk Operational hand-held radios Internet e-mail Web page management and monitoring Fax transmission</td>
</tr>
<tr>
<td>Channels and facilities</td>
<td>Multiple, agency-specific radio channels Owned or borrowed hand-held radios and base stations Telephone networks Cell phones Owned or leased fiber-optic cable Some intranet Dedicated system-specific terminals</td>
</tr>
<tr>
<td>Language</td>
<td>Agency-specific data formats Variety of agency-specific operational terms and message codes Multiple, established (or no) geographic referencing conventions</td>
</tr>
<tr>
<td>Message reliability and timeliness</td>
<td>Reliability dependent on initiative and understanding of roles and contacts Filtering uncertainties (voicemail, unconfirmed message read) Confirmation assurance lacking</td>
</tr>
</tbody>
</table>

The characteristics of today’s inter-agency communications are summarized in Table 3-3.
Inter-agency Capabilities | Characterization of Current Situation
--- | ---
Mission-focused listening and translation losses when relayed | “Separately initiated” messages and data
Various agency-specific priorities and urgency levels | Little or no operational integration
Operational integration | Little or no operational integration

For regularly occurring events and minor incidents that stress the transportation network, many agencies in the region have responsibilities and the opportunity to anticipate, respond, and mitigate each event and recover from its effects. For the most part, the agencies involved have extensive experience in managing these situations. Some agencies have procedures and protocols for action and coordination with other agencies. Other agencies coordinate on a more ad-hoc basis. For most agencies that need to act on these incidents, the key to effective action is timely notification to all parties that need to be notified and timely exchange of dependable information on status and conditions on the transportation network.

The communication challenges and risks posed by regularly occurring events and minor incidents are magnified during major incidents and unanticipated events. In these cases, notification is provided via many channels, and efficient delivery of authoritative, situational information requiring action is critical to agencies that need real-time data to make sound decisions for effective response. The duration of an incident, combined with its impact on the transportation network, necessitates a more extensive regional approach toward traffic mitigation and recovery. When information dissemination is not coordinated, the more agencies involved in a major incident increases the likelihood that not all agencies are receiving the same basic information that, in turn, increases the opportunity for improper or less-than-ideal scenario management. In major incidents, redundant information channels are needed because normal communication facilities may be down or disrupted. The current inter-agency communications practices in the region do not adequately support this situation.

Transportation agencies can be affected by the status of other nearby feeder facilities or services. For instance, New Jersey Transit operations into and out of the City of Philadelphia are nearly always affected by conditions on the Ben Franklin Bridge and by roadway construction and maintenance on both Philadelphia streets and New Jersey local roads and state highways. On the highway side, feeder roads to the Pennsylvania Turnpike are monitored and managed by PennDOT, yet their conditions have a direct impact on traffic volumes and toll operations on the Turnpike.

In summary, regional agencies have recognized the risks and potential inefficiencies posed by current inter-agency communications and information-sharing on both infrastructure and operational practices. Characterized by one-to-one communication within a many-to-many structure, this fragmented system, which has evolved sporadically, depends on many situational factors and can be ineffective. A fragmented system means that too often contact points are not reached or established at the right times, phone messages are not received and relayed properly, or all responsible agencies that need a message do not get that message.

The current transportation situation calls for highly effective communication and real-time information sharing to enable responsible agencies to monitor and react effectively to network conditions. The key to effective action is the timely notification of all parties that need to be notified and timely exchange of dependable information on status and conditions on the transportation network. To this end, agencies participating in RIMIS development envision integrated communication and information sharing that will trigger and transmit messages and information as a direct function of their operational activities and decisions.

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2 Predicted weather, sports events, rush-hours, and related items.
3 Accidents, system breakdowns, and related incidents of a short duration and minor disruption to traffic.
4 Such as accidents of a long duration or at critical locations, disaster, major attack, 100-year storm, and widespread toxic event.
3.2 OPERATIONAL POLICIES AND CONSTRAINTS

The list of regional transportation stakeholders comprise at least 40 different agencies and entities. While most stakeholders have internal procedures and agreements with other agencies, no commonly accepted regional guidelines and agreed-upon protocols for emergency and incident management exist. No overarching policies govern or fully constrain the group in communication measures taken. As a practical matter, the stakeholders realize the merit of a coordinated, compatible, and adaptive approach to regional communications. Regional stakeholders are influenced by investments that have already been made in communications infrastructure and by the investment requirements of any new developments.

The Delaware Valley Regional Planning Commission (DVRPC) has been instrumental in coordinating future response to questions regarding Intelligent Transportation System (ITS) architecture in the Delaware Valley. Studies by the Planning Commission and analysis of existing standards suggest that messaging functions, data definitions, and message set standards, as well as data transfer languages and data sharing interfaces create constraints on effective communication that need to be addressed. In addition, New Jersey and Pennsylvania agencies operate with different geographic information system (GIS) standards that also inhibit efficient communication. To be compatible with both sets of standards, systems will require appropriate translation capability.

DVRPC and RIMIS stakeholders have reached practical consensus and decisions on general principles and development policies to address these constraints for RIMIS as follows:

- **Promotion of inter-agency communication.** The RIMIS goal is to establish improved regional coordination through communication. The highest priority objective for the near term is to facilitate inter-agency messaging throughout the region and establish RIMIS infrastructure. Then more comprehensive RIMIS functionality can be phased in at the point interested agencies are prepared to move forward.

- **Decentralized RIMIS.** While RIMIS may require shared equipment and system management person(s) to reside in one or more “central” locations, no centralized RIMIS transportation management operations are contemplated. Participating agencies do not expect to delegate agency-specific mission roles and responsibilities, and funds are not anticipated to be available for such a center of operation. Stakeholders recognize that RIMIS will need some management investment on an ongoing basis to support the system and to ensure that RIMIS evolves effectively as user needs grow or change.

- **User control of filtering, data selection, and use at RIMIS interfaces.** RIMIS access and functionality should be made available to all stakeholders in RIMIS development, but stakeholders want to have full control over messaging and information that they choose to send or receive on the network.

- **Ownership of ITS assets.** Agencies owning or investing in deployed ITS assets on the network will retain ownership and control of their use.

- **Corridor compatibility.** RIMIS should be developed and configured so that it is likely to be compatible with future versions of the I-95 Corridor IEN.

- **Accommodate user and use levels.** RIMIS should be developed to accommodate agencies that mainly provide information to the network, agencies that mainly receive and network data, and agencies that interface with the network in both ways. RIMIS should be adaptable for light users as well as “power users.”

- **Flexibility to adapt to ITS development.** Agencies may or may not establish new transportation management centers or invest in deployment of new ITS assets on the transportation network. RIMIS is expected to be scalable and able to accommodate these developments over the long term.

Although RIMIS can play a critical role in advancing the goal of improved information sharing within the Delaware Valley, its foundation rests on a reliable network architecture and backbone infrastructure.
among member agencies. Within this context, a Regional ITS Architecture Plan for the Delaware Valley remains only partially developed. Also no current communication system exists that can be modified to accommodate a regional integrated information-sharing system. Nor do any RIMIS stakeholders currently dedicate full-time, permanent personnel to managing and coordinating inter-agency sharing of operational information. Many regional agencies however, have expressed an interest in redirecting resources to more productive communication methods instead of engaging in current practices such as reviewing faxed transmissions.

At least one regional transportation agency prohibits Internet connections with any computer on its operations center network because of security concerns. Many agencies share similar system security concerns but recognize the need to provide an appropriate environment for external network connections. Another RIMIS stakeholder prefers receiving raw data and messages only, without higher level functions or additional capability (e.g., a GUI). PennDOT plans to become more involved in managing expressway corridors, including controlling traffic signal timings when traffic is diverted off an expressway; however, municipalities (and not PennDOT) own and operate traffic signal systems in Pennsylvania. To address this potential conflict, new institutional relationships are being developed.

Commercial traffic information service providers currently have exclusive agreements for the use of data from their traffic monitoring devices located on area roads. Transmitting this data according to other schema may require new agreements governing the use of this information. The public will not have access to the RIMIS database; they will indirectly receive RIMIS information via traffic information services that are provided by RIMIS partners.

This RIMIS CONOPS is also based on reasonable assumptions of ITS development in the region over a 10-year time period. For example, it is assumed that at least three agencies (DRPA, Streets Department, and Sports Complex) will have consolidated their operations management into operation centers in that time. In addition, traffic volume and speed data are likely to be available on some routes from new sensors or other ITS equipment that are expected to be deployed.
3.3 **Motivation and Scope of RIMIS**

Although transportation agencies in the Delaware Valley region are motivated by common interests in monitoring and enhancing the safety and efficiency of the region’s transportation network and in managing the network’s incidents when these occur, each agency has a primary mission and responsibility that determines operational priorities. In emergency situations, agency priorities often conflict. For example, an operational decision driven by concern for public safety often must trump concerns about traffic congestion. An important function of effective inter-agency communication is to ensure that all network agencies can recognize when such mission tradeoffs arise and to provide enough information for agencies to understand and mitigate the situation to the greatest extent possible.

Agencies involved in management of the transportation network have worked together through many events and incidents that have challenged the limited available channels of inter-agency communication. In this light, the overall objective of RIMIS is to foster better communications and information-sharing between the many agencies in the region. Meeting this objective is critical to the effective management of the complex transportation network in the Delaware Valley. The consensus among the stakeholders is that better inter-agency communications will:

- Enhance traffic management of recurring congestion and peak travel
- Provide for faster and more effective response to unexpected incidents and events
- Improve use of systems to inform and influence the decisions of travelers
- Help realize the full value of ITS/communications assets already deployed in the region
- Speed up the process of information request and transfer, which can be especially problematic during emergencies, when many normal staff or administrative functions are temporarily stopped or the situation has low priority in their agency
- Improve the region’s incident and emergency response capabilities based on the analysis of past events, archived data exchanges, and communication patterns.

RIMIS will connect key decision makers and operations centers on an information network to make better use of existing information infrastructure (on both traffic and transit conditions) and to better respond to incidents and manage special events. These centers include:

- Traffic management centers
- Emergency management centers (including 911 centers, police, and fire departments),
- Transit Operations Centers
- Information service providers (e.g., traffic reporting services).

RIMIS will enable the following types of information to be shared to full potential among regional transportation stakeholders:

- Incident notification as soon as a problem is detected or reported
- Incident severity designation and expected duration
- Incident response decisions and activities
- Situational status on incidents and the “big picture” transportation context
- CCTV images to view traffic and incident conditions throughout the region
- Special events and management plans
- Traffic and transit conditions including route performance data
- Traffic management resources and status of current notifications and warnings
- Construction and maintenance activities that close lanes on expressways, detour routes, and bus routes.

Currently this range of information is generally not available in a timely manner to all agencies that require it for effective, coordinated decisions and action. RIMIS stakeholders envision this information to be
shared through a combination of directed and “broadcast” messaging on the system and through direct access and use of databases and operational information available at “source” agencies.

In addressing the need for RIMIS, stakeholder agencies have cited numerous areas in which RIMIS could and should enable communication improvements that will add to the efficiency and effective management of the transportation network. While stakeholder agencies view the broader transportation network perspectives as important, they assess the value of investments and commitments to the specific missions for which they are accountable. The motivations to adopt RIMIS most commonly expressed by regional transportation management agencies are shown as follows.

**Primary Internal Motivations for Regional Agencies to Adopt RIMIS**

- Increase the confidence of stakeholder agencies that they are acting on timely and credible incident notifications and situational information during routine and emergency operations
- Increase their confidence that during routine and emergency operations they have provided timely and credible incident notifications and situational information to all agencies that need to take coordinated action
- Increase their confidence that they have full knowledge of the transportation network “big picture” at all times
- Reduce the cost of ad-hoc procedures to obtain needed information
- Quickly acquire information that is known to exist and to be available but is difficult to request or communicate on short-notice
- Obtain reliable information directly from sources that are vested in the quality and currency of the information, rather than through ad hoc sources and methods
- Enable better, faster interpretation of information through regular access and experience with the formats and protocols used by the “source” agencies
- Improve reliability, redundancy, and resilience in regional communications network links that are crucial in major regional emergencies
- Increase their knowledge of the range of useful network information available—some of which may be critical but has been used so rarely that its source or availability is unknown or forgotten.

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5 Discussed further in subsequent sections.
3.4 **MODES OF OPERATION FOR THE CURRENT SITUATION**

No system exists with the capabilities and functionality expected of RIMIS. The new system will manage messages and data that are not being shared currently over a network in normal transportation management. RIMIS is intended to support over-the-road and rail transportation management operations in the following modes and situations:

- Normal recurring congestion management
- Lane closures for maintenance or construction
- Special events
- Minor incidents and emergencies (e.g., minor accidents, exceptional congestion, weather events)
- Unusual incidents and emergencies (e.g., major accidents, major disasters, evacuations).

Inter-agency communications needs may vary in intensity and message content under these modes, but the functions of RIMIS will generally be the same, from a high-level view. RIMIS will serve as a facility and resource for agencies to help them make decisions, communicate decisions, and perform authorized missions to deal with these situations on a timely basis.

3.5 **USER CLASSES AND INVOLVED PERSONNEL**

Potential RIMIS user organizations are categorized into six classes, as shown in Table 3-4:
### Table 3-4
**Potential RIMIS User Organizations**

<table>
<thead>
<tr>
<th>Organization Type or Class</th>
<th>RIMIS User Organization</th>
</tr>
</thead>
</table>
| **Transportation Operations and Facilities** | Burlington County Bridge Commission  
                                            County/Municipal Traffic Operations Centers  
                                            Delaware DOT  
                                            Delaware River & Bay Authority  
                                            Delaware River Joint Toll Bridge Comm.  
                                            Delaware River Port Authority  
                                            NJ Turnpike Authority  
                                            NJDOT Statewide Traffic Operations Center  
                                            NJDOT Traffic Operations South  
                                            PennDOT Statewide Traffic Operations Center  
                                            PennDOT District 6-0  
                                            Philadelphia Sports Complex  
                                            Philadelphia Streets Department  
                                            Port of Philadelphia Terminals  
                                            South Jersey Transportation Authority |
| **Transportation Providers**         | AMTRAK  
                                            NJTransit Operations South  
                                            Philadelphia International Airport  
                                            PATCO  
                                            SEPTA |
| **Emergency Responders**            | Delaware State Police  
                                            Municipal Police/fire Departments  
                                            NJ Office of Emergency Management  
                                            NJ State Police  
                                            PA Emergency Management Agency  
                                            PA State Police  
                                            Philadelphia Fire Department  
                                            Philadelphia Police Department |
| **County 911's**                    | Bucks County, PA 911  
                                            Burlington County, NJ 911  
                                            Camden County, NJ 911  
                                            Chester County, PA 911  
                                            Delaware County, PA 911  
                                            Gloucester County, NJ 911  
                                            Mercer County, NJ 911  
                                            Montgomery County, PA 911  
                                            Philadelphia County, PA 911 |
| **TMA's**                           | Bucks County PA TMA  
                                            Chester County PA TMA  
                                            Cross County Connection TMA  
                                            Delaware County TMA  
                                            Greater Mercer TMA  
                                            Greater Valley Forge TMA  
                                            The Partnership TMA |
| **Information Providers**           | AAA Mid-Atlantic  
                                            I-95 Corridor Coalition  
                                            Center City District  
                                            Philadelphia Convention and Tourist Bureau  
                                            Metro Network/Westwood One (Smart Routes)  
                                            Traffic.com  
                                            TRANSCOM |
Most agencies have some form of operations dispatch or control center for monitoring and command and control of operations. These centers vary in degree of centralization, technical sophistication, hours of operations, number, and hierarchy of personnel assigned to related tasks, as well as their levels of responsibility.

Current efforts at sharing information and coordinating activities are oriented toward using telephone and text message transmissions, faxes, e-mail, and web posting. Agencies most involved in these efforts depend on a variety of staff and positions to accomplish these activities. These staff and positions will be affected when RIMIS is implemented:

3.5.1 Organizational Structure

The organizational structure of RIMIS will be determined when its functionality becomes clear and the level of its use by agencies is known. Given its decentralized nature and serving as a system for communications and information exchange (without direct operations decision-making responsibility for transportation), RIMIS will provide the following support functions:

- Establishment of RIMIS budget and system priorities
- Contract services
- System administration and customer service
- Needs assessment and upgrade management
- Configuration management
- Quality management
- Maintenance and help desk support
- Training.

The organizational structure will require a form of oversight representation, perhaps consisting of representatives of the most extensive users of the system. As a minimum, feedback mechanisms should exist and be managed for all future users of RIMIS. Because it may have to accommodate the unique needs of many agencies, RIMIS may incur additional staffing expenses.

3.5.2 Profiles of User Classes

Table 3.5 lists classes of user organizations targeted in the RIMIS concept. The RIMIS approach to system usage will be to define its “user classes” according to these commonly known categories of transportation management. Future system development documentation will profile the typical RIMIS interaction of the seven organizational user classes listed. Section 5 addresses the expected interactions of user classes with RIMIS.

### Table 3-5
**User Classes**

<table>
<thead>
<tr>
<th>Operations and Maintenance Management Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Oversee top-level operations and maintenance activities of state DOTs, state and local transportation operations centers, or transit authorities</td>
</tr>
<tr>
<td>• Supervise staff, coordinate resources, and exercise authority to commit resources for the agency</td>
</tr>
<tr>
<td>• Responsible for budget development and identification of funding sources and coordination of interagency programs such as maintenance, construction, and special events with state and local jurisdictions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control Center/Dispatch Center Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide technical responsibility for operations/control/dispatch centers, facility, staff, and daily operations</td>
</tr>
<tr>
<td>• Coordinate programs such as system enhancements to upgrade operations/control/dispatch operations</td>
</tr>
</tbody>
</table>
• Manage agency systems (e.g., freeway or transit management, and supporting infrastructure)
• Coordinate with interfacing functions (e.g., maintenance, safety, and administrative).

**Operators/Dispatchers**

• Monitor internal agency systems and operation status
• Notify staff, supervisors, internal and external departments, and appropriate authorities of emergency response needs
• Dispatch resources and coordinate fleet or field personnel response to traffic and incident issues
• Troubleshoot system operations.

**Information Technology Staff**

• Implement, repair, and provide maintenance of communications equipment, infrastructure, and databases
• Assess system operations, databases and networks to troubleshoot potential system errors
• Specify, procure, and install telecommunications infrastructure to support agency operation function
• Implement appropriate network security measures consistent with agency policies.

**Emergency Management Authorities**

• As regional and state entities responsible, ensure the safety and security of employees and the public;
• Evaluate security programs and plans for compliance with state and federal regulations
• Establish protocols for large-scale emergency notification, response, and multi-agency coordination.

**Public Safety Operators/Dispatchers**

• Provide 911 operators, as well as dispatchers at police, fire, and other emergency responder communications facilities;
• Answer emergency calls and dispatch to the appropriate emergency response agency
• Initiate CAD logs for incidents, including initial call, incident details, dispatch details, and updates.

**Emergency Response/Law Enforcement Personnel**

• Provide police, fire, ambulance, and other emergency response staff from the states, cities, counties, bridge authorities, transit, and others.

**Information Service Providers**

• Generate information that will be used within the RIMIS messaging infrastructure
• Disseminate appropriate subset of information to the public

**Public Affairs/Community Relations**

• Provide management and liaison with the media and general public for dissemination of information and press releases
• Coordinate events and work with other agencies as part of multi-agency efforts
• Respond to media requests regarding incidents, road closures or public safety concerns.

**Program Management and Administration Staff**

• Serve as program managers and administrators in non-operational roles in overall program management, guidance, contract management, funding, and other key administrative components of the program.
Outside Vendors

- As manufacturers of ITS devices, serve as designers of system enhancements or interfaces for data exchange or contractors that support agency staff to perform the day-to-day activities.

Each agency involved in regional transportation issues faces different problems, and each has a unique organizational structure, whether modeled on functional expertise or on decentralization and local autonomy. The common responsibilities of most agencies are to:

- Monitor the operations and maintenance activities of their facilities and/or services
- Supervise and manage system or facility performance
- Respond to maintenance or operational requirements
- Safeguard facilities and to respond to emergencies
- Communicate between parts of the organization
- Communicate with external agencies and the public.

Information management responsibilities are often diffused in stakeholder organizations. This makes clear, timely, and reliable inter-agency communications very difficult or unlikely. Some agencies, for example, give the individual operations center dispatcher the authority to place a notification call to another affected agency, while other agencies require a supervisor’s approval before a notification is transmitted to another agency. Recognizing that the public may access their website information, many agencies require a Public Affairs officer to review notification messages indicating trouble. Except in small operations or during low-volume hours, this important review function cannot be expected to be performed reliably every time by one person.

3.5.3 Interactions Among User Classes

Interactions among user classes vary between agencies depending on organizational and control philosophy, size, and past practice. For many agencies, internal policies have given authority for resolving incidents to personnel at the scene and in the field. With automation and better information in the hands of centrally located managers, authority has tended to migrate toward centralized operations/control/dispatch centers, which can more effectively view the larger operational situation and the resources available. Based on these considerations, some agencies will want to limit access to RIMIS exclusively to their operation center staff. Others will want multiple access points to RIMIS, reflecting their geographically dispersed operations staff or localized decision making.

Information that is shared with outside agencies may also require a sequence of prior interactions between classes of users within an agency, because agency policy may dictate that only operational shift supervisors communicate with outside parties. Responding to legal requirements and privacy concerns, agencies also have policies on types of information they can disclose to outside organizations. For example, county 911 responders and state police are sometimes reluctant to disclose Computer Aided Dispatching (CAD) information to non-emergency response agencies. Another example is the practice of Departments of Transportation to suspend video feeds to traffic reporting services and their Internet websites when the departments are viewing an accident scene.

3.5.4 Other Involved Personnel

Executive-level transportation agency managers typically do not communicate operational emergency conditions or incidents but need to be informed of serious operations cases in a timely manner. Incidents reported from outside agencies or events that may ultimately affect the agency also may need to be communicated to the executive leadership. In extreme events, top-level executives often visit the operations/control/dispatch center to ascertain the current status of events. Some agencies currently have the ability to graphically or visually depict incidents and the big picture; most do not.
3.6 **SUPPORT ENVIRONMENT**

The support environment for RIMIS must be geared to address two levels of functionality. The first is a traditional help desk type of activity that permits users to call with questions on the operation of the application or any perceived RIMIS-related problems. It is suggested that the technical infrastructure support team of each agency be trained to expand its scope of end user support by including RIMIS. This training will put a relatively small additional burden on in-house support staff while defraying the costs of creating a large-scale RIMIS help desk. Also, each user organization is most familiar with its own network; therefore, by having its own trained help desk staff, it will be in the best position to diagnose in-house networking problems successfully.

The second level of functionality requiring support will be the operational infrastructure responsible for delivering RIMIS data to all of the member user organizations. This support will be more technical and typically will occur between the network infrastructure team of a particular agency and a RIMIS datacenter technician. The purpose of these types of interactions will be to find out why RIMIS messages from an organization are not reaching RIMIS or why end users of the organization are receiving no messages on their RIMIS screens. The RIMIS technical support team will be knowledgeable about the hardware and software technologies used by the RIMIS messaging infrastructure and about the implementation of the RIMIS interface point to member organizations. The team will not be able, however, to develop expertise in the technologies that reside in all of the user organizations, given their number and various states of flux. Therefore, the responsibility for the successful troubleshooting of any problem rests with both the RIMIS support team and each organization’s internal support group.
4.0 JUSTIFICATION AND NATURE OF THE NEW SYSTEM

To address the regional transportation situation and management realities described in the previous section of this CONOPS, a flexible and dependable inter-agency communications and information sharing system is needed in the Delaware Valley. Agencies typically communicate on a one-to-one basis with other agencies, using resources available (e.g., telephone, email, Nextel phones, and handheld radios). The current approach is highly dependent on established personal relationships, unwritten historical knowledge, direct contact information, and thorough staff understanding of operational protocols. Stakeholder organizations agree that enhanced information-sharing and communication can improve the efficiency and effectiveness of inter-agency operations during regularly occurring events as well as addressing the current breaks downs that are more likely to occur when transportation management issues involve more regional, non-routine situations.

This complex situation in the region justifies and requires an integrated communications and information sharing system to address the problems and challenges described in Section 3. RIMIS will meet inter-agency communications capability needs by:

- **Enabling communication simultaneously with multiple agencies**—To ensure full and timely notification of events and situational status to all concerned parties, rather than the selective and sequential one-to-one process currently in place.
- **Using “standard” messaging for some communications**—To improve the content, completeness, and clarity of some communications that now often pass word-of-mouth through a chain of individuals.
- **Providing “big picture” situational information**—To allow agencies to determine actions needed, rather than relying too heavily on the judgment and initiative of others, as sometimes happens today.
- **Providing video of incidents and other unusual conditions**—To allow agencies to visually confirm the field situation.
- **Providing information to emergency responders and others on the best routes to reach the scene of an incident**—To improve the current situation in which this information is often unavailable or not able to be shared.
- **Providing immediate access to available background data**—To reduce the time required today for requests, responses, and analysis.
- **Enabling confirmation of message notifications and actual situational information in real time**—To avoid today’s tedious follow-up communications and requests, when time for action is short.
- **Translating differences in “languages,” referencing systems, or protocols among agencies**—To ensure that information can be better understood and used by each agency’s operating personnel.
- **User-filtering and enabling control of the communications system interface**—To reduce the burden of unnecessary or unwanted transmissions and allowing agencies to use their own criteria for internal notifications and processes.

Federal regulations require that all ITS projects must demonstrate their consistency with a regional ITS architecture. This consistency was identified as a local component of the National ITS Architecture by the ITS Technical Task Force and outlined in the March 2001 publication of the “Regional ITS Architecture (v 1.0).” The “Implementation” section of the Architecture identifies the need for RIMIS as a mechanism to interconnect traffic management, transit management, emergency management centers, and information service providers. It identifies 28 stakeholders or categories of stakeholders that would participate in RIMIS.

This CONOPS confirms the original stakeholder list (with some private sector information service providers having since been added), and identifies additional stakeholders such as the Burlington County...
Bridge Commission, Pennsylvania Emergency Management Agency (PEMA), and the Philadelphia Sports Complex. The Architecture divides RIMIS implementation into two phases. The initial phase includes information flows that deal with traffic information, traffic control, incident information, transit coordination, and transit emergency data. The second phase expands the list of information flows to archive data, current network conditions, remote surveillance, incident response coordination, transit system data, transit fares and schedules, and information for the media.

In general, the full list of Architecture data flows has been confirmed. Construction and maintenance activity and special event information have been identified as additional needs beyond what those identified in the Regional ITS Architecture; transit fares and schedules have been eliminated as a need. Emergency management CAD information, not specifically mentioned as part of the National ITS Architecture, has been identified as needed information.

The planned RIMIS will not build directly on existing agency systems in the Delaware Valley that contain and share transportation-related information, but must interface with them. This fundamental characteristic of the planned system allows for an engineering approach that envisions a new system with its own key hardware components and functional requirements, including a customizable GUI and standard connectivity and performance characteristics. No real changes or modifications to existing communications systems and media are contemplated.
4.1 **JUSTIFICATION FOR FEATURES OF THE NEW SYSTEM**

RIMIS is expected to meet the communication and information-sharing challenges of current regional transportation management. Elements of the high-level rationale for the main features of the new system include:

- Directed and “broadcast” messaging
  - Eliminates time consuming processes that only send messages one agency at a time
  - Provides capability to replace ad-hoc e-mail practices and fax servers
  - Ensures all parties receive messages that should receive them
  - Enables timely evaluation of specific problem, location, context, and related items
  - Enables content and standards to be automatically applied to some messages
- Message confirmation and response
  - Provides assurance that messages are received and under consideration for action
  - Provides information needed for coordination decisions
- Situational status “thread” messaging
  - Provides updates for coordination
  - Provides triggers needed for new action decisions
  - Informs on conditions for close out of the incident
- Database/Resource sharing
  - Provides needed background on pre-existing activities and schedules, and on resource status
  - Provides visibility of agencies’ applicable current operational information (e.g., VMS status, video)
- Archiving transaction history
  - Provides chronological review of transportation management events
  - Enables lesson-learned and “post-action” assessments
  - Saves time in report preparation
- Tracking
  - Enables efficient coordination of multiple activities
  - Supports operational personnel “watch” changes
- GUI and GIS Mapping
  - Provides unified source for users to view traffic conditions, incidents, and traffic resources
  - Provides detail information by clicking an icon, eliminating the need to search different sources
  - Using GIS mapping, enables users using to display different sets of information depending upon conditions
  - Using GIS mapping, enables users to display areas of interest.

Owners and operators of regional transportation facilities should be able to better access and exchange status and incident information with each other, so that the overall network can be adjusted in response to all types of transportation scenarios.

The new system will address the current information-sharing challenges and provide the intended functionality and organization to meet the justified purposes cited earlier. As discussed in the System Overview (Section 1.3), the general nature of the system is a semi-automated, real-time transportation network information and message-based information-sharing system. The specific features of the planned system are first described in Paragraph 4.2 and are detailed in Section 5.
4.2 DESCRIPTION OF DESIRED NEW SYSTEM FEATURES

The basic GUI of RIMIS will incorporate real-time transportation network status data through a user-selected graphical map display and a suite of messaging features to support enhanced network status information sharing, regional and localized traffic management, incident response and management, and special event traffic and transit management. Interfacing capabilities are intended to incorporate single point-of-entry for messaging and information transmission and receipt.

RIMIS will enable information flows that include:

- Incident/Event information, including location, description/type, duration expectations, status
- Incident response and coordination, resource requests, VMS messages, coordinated detours
- System message traffic on progress of incidents/events
- Video data from present and future cameras deployed on the transportation network
- Traffic and transit operations status and conditions
- Planned events and scheduled projects expected to affect traffic and/or transit
- Construction and maintenance information, lane closures.

RIMIS also will archive, will use historical traffic data, and will log interagency communications.

The new system features and the sections that address them are as follows:

- New System Capabilities (Section 4.2.1)
- New System Processing (Section 4.2.2)
- Interface and Data Exchange (Section 4.2.3)
- Personnel (Section 4.2.4)
- Operational Environment (Section 4.2.5)
- Operational Changes as a Result of the New System (Section 4.2.6)
- New System Support (Section 4.2.7).

4.2.1 New System Capabilities

RIMIS will provide agency workstations or interfaces with new capabilities, system-processing characteristics, and interface specifications. In this section, we also address recommendations on agency personnel usage and the system’s operational environment.

Transportation Network Status Display

RIMIS will automatically collect and distribute transportation network status data through direct or indirect interfaces with regional traffic monitoring equipment. Transportation network status information will depend on existing and planned ITS traffic monitoring equipment deployed throughout the region. Data from this equipment will be shared with RIMIS by participating agencies. A graphical presentation of relevant traffic monitoring equipment data and other spatial data generated by RIMIS partners will be standardized through a data transmission standard, data translation capabilities, and a common or harmonized spatial referencing capability. Automated real-time RIMIS transportation network monitoring and graphical map display data and capabilities will include visual presentations, such as:

- A map-based regional transportation network display
- Spatial analysis tools associated with the transportation network display
- User class/User profile customizable display settings
- Network “data layer” filtering capabilities

6 Widely desired by users to eliminate the need to enter information into agency operating systems, then to re-enter similar data into the communications system, and vice-versa. This will require integration with existing systems/GUIs, and possibly some automatic message triggering as transactions occur on agencies’ operations systems. For policy reasons, some users may opt not to integrate RIMIS points of entry with their systems.

7 Probably including route flow, speeds, or other performance data.
• Transportation network level-of-detail display standards based on the desired display/zoom scale
• Input screens and display boxes.

Types of RIMIS transportation network status display data may eventually include the following desirable features:

- Incidents, including accidents, weather conditions, and vehicle breakdowns
- Agency-source traffic-flow monitoring data
- Network ITS device status, current VMS, and Highway Advisory Radio (HAR) messages
- Transit vehicle location, route schedule, and delay information
- Agency-source traffic camera video, CCTV locations
- Planned closures (construction and maintenance)
- Special events data
- Detour information, including detour routes and traffic control points
- Commercial traffic information service provider–source traffic camera video
- Commercial traffic information service provider–source traffic flow monitoring data.

**Electronic Messaging**

RIMIS electronic messaging capabilities will enable a structured methodology for sending and receiving operational information between participating RIMIS centers. Messages between participant centers will be generated manually and, whenever possible, automatically by existing agency systems, such as CAD systems or incident management systems. Specific messaging capabilities will include the following essential features:

- Message composition templates with pull-down menus for efficient and standardized addressing, description of incident types, expected durations, locations, resources required, and time of day
- Incoming message bar
- Manual and automated broadcast messages, alerts, and notifications
- Limited-recipient messages, alerts, and notifications (sent to a selected group or individuals for more specific communications)
- Directed messaging
- Automated alerts triggered by the RIMIS based on transportation network status information in the form of map display information and messages
- Scenario-based (e.g., highway incident, bridge incident, special event, HAZMAT spill, recurring congestion, and non-recurring congestion) message templates, user groups, and resource-sharing support capabilities
- Filters for message recipients to select which broadcast messages may be applicable to their organization. A feedback mechanism will inform message senders which messages have been delivered and which remain unread. Senders will be able to override the filters if conditions warrant.

Messages will be configured in a manner to be consistent with National ITS Standards for messages.

**Data Archiving**

Some of the participants’ data provided to RIMIS will be stored in an archive to:

- Trigger planned automated traffic management system alerts (based on deviations of current conditions or performance on network segments from the average performance for the same time of day calculated through the use of historical data).
- Conduct specific manual planning analyses.
• Serve as a valuable record of decisions, messages exchanged, and actions taken for incidents and other scenarios. This function will allow users to better use the system and respond to or manage future transportation scenarios.

A distributed data archiving scheme could be used in keeping with the distributed architecture scheme. Another option is that this item could be centralized and managed by one of the RIMIS partners or through outsourcing this function to a commercial traffic data provider (see Section 5.3.3).

**Incident Tracking**

RIMIS will have the capability to zoom in on incidents and track response progress by generating a message log and by alerting and initiating correspondence between various pre-determined user groups based on the mode and jurisdiction of the incident.

**Video Conferencing**

Video conferencing will enhance the ability of different agencies to speak to each other while trying to develop or coordinate a joint response to an incident. It will allow offsite agencies to participate in meetings that they cannot attend in person.

**Agency Contacts**

Even though the objective of RIMIS is to automate information sharing among transportation and emergency response agencies in the Delaware Valley, under some conditions personal contact among agencies will still be required. RIMIS can provide an up-to-date source of contact names beyond those normally contained in agency procedure manuals.

**System Security**

A high level of security will be important to the success of RIMIS. The use of state-of-the-art security solutions, including encryption, firewalls, tiered access protection, and attack detection software, will be essential to a successful deployment of RIMIS.

### 4.2.2 New System Processing

RIMIS processing will require consistent automated and manual inputs for a wide variety of transportation-related data, such as:

- RIMIS transportation network traffic-flow data
- Planned closures and events
- Maintenance and construction activities
- Electronic message text.

Outputs of all information processed by the system will exist within the graphical map display, messaging, and data archiving components.

For agencies that wish to use RIMIS as their own internal database, they will have the ability to design and customize screen input areas allowing them to store information of interest to them and no other agencies.

### 4.2.3 Interface and Data Exchange

RIMIS interface and data exchange standards will be consistent with existing C2C protocol standards defined by the National Transportation Communication for ITS Protocol (NTCIP) committee. A common data dictionary to be used, possibly in an Extensible Markup Language (XML) formatted file, will also ensure that distributed RIMIS nodes and RIMIS data interfaces with outside systems will work properly together. RIMIS data interfaces may be customized for some agencies to allow them to access or extract internal agency data and translate them into RIMIS format. This enhanced system interoperability
capability will reduce or eliminate the need for double data entry, enhance the speed of communication, and reduce the possibility of human error introduced by the retyping of information. Agencies acquiring such RIMIS data interfaces will be able to do so at their own discretion as RIMIS advances.

RIMIS will have a data interface with the I-95 Corridor Coalition IEN that can serve as a common interface between agencies on RIMIS and the I-95 IEN, thus eliminating the need for local IEN workstations.

4.2.4 Personnel

Personnel types who may use RIMIS as a tool within their job role and/or help maintain components of the overall system, include the following user classes:

- Operations and maintenance management personnel
- Control center/Dispatch center manager
- Operators/Dispatchers
- Information technology staff
- Emergency management authorities
- Public safety operators/dispatchers
- Emergency response/Law enforcement personnel
- Public Affairs/Community Relations offices
- Outside vendors.

As the systems evolve, participating agencies may need IT personnel to manage changes in translation and interface software at the point of connection to their respective operating systems. Strategy for staffing of RIMIS system and configuration management is to be determined, depending on the evolution of the system concept.

Not all agency classes will have access to the same level of information. For example, traffic reporting companies and TMAs will not have access to sensitive incident information. In addition, any information received from private sector traffic services will not be shared with other private sector companies.

4.2.5 Operational Environment

In the regional operations environment, the system is intended to promote communication, responsiveness, and trust between transportation network managers; emergency responders; information service providers; and other RIMIS stakeholders. RIMIS represents the introduction of a new information-sharing medium in addition to the continued ability to use existing forms of network status information (i.e., TV media, agency source video) and communication (i.e., radio, telephone, push-to-talk, e-mail, and fax).

From a technical perspective, RIMIS may require agencies to permit an outside entity to gain access to certain data inside their firewalls. Agencies that do not comply with National ITS Standards, data dictionaries, and message sets may have to convert their data before allowing such access. It is also possible that this type of conversion may become a centralized RIMIS function if the data were “pushed” by participating agencies.

4.2.6 Operational Changes as a Result of the New System

It is intended that RIMIS will have a limited impact on agency-specific operational environments. The stakeholders understand that the solution is not “one size fits all;” therefore, changes in existing system functions, processes, interfaces, and personnel will hopefully be kept to a minimum. The new system is being created as a tool that will likely enhance the efficiency and effectiveness of current inter-agency coordination, reduce costs, and not require significant changes to normal routines and processes of agencies and centers. In some operations, centers, and offices, new daily work routines may include monitoring the RIMIS network display and alerts, as well as initiating and responding to broadcast and directed messages.
Under the future RIMIS operating scenario, agencies may still make phone calls to critical responders as required by agency operating procedures. The messaging ability of RIMIS will expedite broadcasting information to secondary agencies that are normally not contacted under current procedures. Agencies can request assistance from other agencies, but the requested agency retains the right to grant or reject the request based on agency operating procedures or other competing requests for resources. Video sharing will help emergency responders to confirm an incident and to begin organizing a response before the first emergency vehicle arrives at the scene. Responders will be able to use video feeds to determine the best way to reach the accident without getting stuck in traffic. The RIMIS implementation period is anticipated to make an additional impact on agency operations and staffing, including training personnel and developing customized screens for the system operators.

4.2.7 New System Support

Apart from possible outsourcing roles for data archiving, data processing, and centralized system maintenance, it is not expected that RIMIS will require significant support from personnel within each agency. System interface modifications, data exchange testing, troubleshooting, and other technical support may be required of agency IT staff during system implementation and subsequent upgrades.
4.3 **PRIORITIES AMONG NEW SYSTEM FEATURES**

System features have been initially identified through evaluation of the needs and constraints of RIMIS stakeholders and may be prioritized as one of the following:

**Essential:** Features that are very important to the success of the new system

**Desirable:** Features having significant value but are not critical to the success of the new system

**Optional:** Features that have value to some but not all agencies and may be implemented on an as-needed basis

Classifying the desired changes and new features into essential, desirable, and optional categories is important to guide the decision-making process during development of the proposed system. *Tables 4-1 through 4-5* are suggested prioritizations of RIMIS features.

**Table 4-1**

**Essential RIMIS Features**

<table>
<thead>
<tr>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>System security and protections</td>
</tr>
<tr>
<td>Expandable and customizable basic GUI</td>
</tr>
<tr>
<td>Manual directed messaging</td>
</tr>
<tr>
<td>Manual broadcast messages, alerts, and notifications</td>
</tr>
<tr>
<td>Incoming message bar</td>
</tr>
<tr>
<td>Map-based transportation network display with display detail standards linked to zoom scale</td>
</tr>
<tr>
<td>Incident information and tracking functions, messages, alerts and notifications based on mode and jurisdiction</td>
</tr>
</tbody>
</table>

**Table 4-2**

**Desirable RIMIS Features**

<table>
<thead>
<tr>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial traffic information service provider source traffic-flow monitoring data</td>
</tr>
<tr>
<td>Agency source traffic-flow monitoring data/agency transit vehicle location and delay information</td>
</tr>
<tr>
<td>Network ITS device status</td>
</tr>
<tr>
<td>Planned closures (construction and maintenance) data</td>
</tr>
<tr>
<td>Advance special events road closure/traffic pattern data</td>
</tr>
<tr>
<td>Primary and secondary detour routes, contact names, and other information needed for pre-arranged detours</td>
</tr>
<tr>
<td>User class/user profile customizable display settings with network “data layer” filtering capabilities</td>
</tr>
<tr>
<td>Message composition templates with pull-down menus for efficient and standardized addressing and information inputs</td>
</tr>
<tr>
<td>Spatial analysis tools associated with the transportation network display</td>
</tr>
<tr>
<td>Other scenario-based (e.g. incident, event, traffic information) message templates, user groups, and resource-sharing support capabilities</td>
</tr>
<tr>
<td>Automated broadcast or group alerts and messages of network status, incidents, and traffic conditions</td>
</tr>
<tr>
<td>Data archiving to store messages, incident information, and transportation network data transmissions</td>
</tr>
<tr>
<td>Agency source traffic camera video linked to graphical map display</td>
</tr>
</tbody>
</table>
### Table 4-3
Optional RIMIS Features

<table>
<thead>
<tr>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Homeland Security (DHS) alert data</td>
</tr>
<tr>
<td>Amber alert data</td>
</tr>
<tr>
<td>Filtered 911 and emergency responder dispatch data that can be graphically plotted to display incidents impacting the transportation network</td>
</tr>
<tr>
<td>Commercial traffic-information service provider source traffic camera video linked to graphical map display</td>
</tr>
<tr>
<td>Video teleconferencing among agencies</td>
</tr>
<tr>
<td>Surface temperature/Remote Weather Information Systems (RWIS) data</td>
</tr>
<tr>
<td>Weather data</td>
</tr>
</tbody>
</table>
4.4 FEATURES CONSIDERED BUT NOT INCLUDED

Features or characteristics of the proposed RIMIS system considered but not included are generally divided into two categories:

- Features considered but ultimately deemed unfeasible, inappropriate for the operational environment, or outside the scope of this CONOPS document
- Features under consideration for future addition, but beyond the scope of the first phase of implementation.

<table>
<thead>
<tr>
<th>Feature/Characteristic</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralized system management/operation</td>
<td>Inappropriate for the operational environment, not feasible</td>
</tr>
<tr>
<td>New data sharing/system archiving agreements with commercial traffic information/data service providers</td>
<td>Outside RIMIS CONOPS scope</td>
</tr>
<tr>
<td>Accommodate existing GIS applications and associated location referencing systems and baseline maps</td>
<td>Not feasible</td>
</tr>
</tbody>
</table>

Table 4-5
Features/Characteristics Considered But Beyond Implementation Plan Scope

<table>
<thead>
<tr>
<th>Feature/Characteristic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Archived Data User Service (ADUS) interface for data querying and mining</td>
<td></td>
</tr>
<tr>
<td>GUIs/wireless functional requirements for laptops/handhelds</td>
<td></td>
</tr>
<tr>
<td>Voice-over IP (VoIP)</td>
<td></td>
</tr>
</tbody>
</table>
4.5 ASSUMPTIONS AND CONSTRAINTS

This paragraph describes assumptions or constraints applicable to the proposed system's features identified in this section and further detailed in Section 5.

The assumptions for the proposed system include the following:

- RIMIS will be a decentralized, message-based, semi-automated, and scalable electronic information-sharing system with a common GUI and graphical map display.
- RIMIS will not force excessive changes to individual agency operational processes, policies, and procedures. When possible, RIMIS will not require manual double-entry of data/messages into RIMIS and into agency proprietary systems.
- RIMIS will allow users to send and receive messages about incidents/traffic affecting their own operations and regional, multi-modal operations.
- RIMIS will allow users to receive and seek real-time transportation network traffic-flow information.
- RIMIS will allow users to respond to incidents through enhanced resource sharing.
- Through enhanced desirable features, RIMIS will be capable of delivering only appropriate data for each agency to carry out its own mission and operations.

The constraints of the proposed system include the following:

- The RIMIS messaging function must be consistent with various existing ITS traffic, incident management, and construction management data dictionaries and message sets.
- RIMIS must use existing data sharing and C2C communications standards, as well as a common data sharing interface and data transfer language.
- RIMIS mapping and spatial referencing functions and features must use the Location Referencing Message Specification (LRMS) standard.
- RIMIS must have the necessary data interfaces and message compatibility with other regional information-sharing systems.
- RIMIS must be able to be adapted to future agency organization, jurisdictional changes, and new operations centers.
- RIMIS must operate within or outside agency system security firewalls.
5.0 CONCEPTS FOR THE PROPOSED SYSTEM

5.1 BACKGROUND, OBJECTIVES, AND SCOPE

Sections 3 and 4 provided a regional context for the need, desired features, and desired functions of RIMIS for agencies in the Delaware Valley. Through interviews with individual agencies, input and direction from the RIMIS subcommittee, and interactions with potential users as part of an Operational Scenario Workshop, the following guiding principles emerged that provide a focus for developing a concept of how RIMIS needs to serve the partner agencies:

- Make only a minimal impact on current agency operations
- Provide a “common backbone” for information sharing
- Provide a messaging capability to allow agencies to notify, request, and respond in real time
- Anticipate future functionality and requirements
- Allow flexibility at the local level to customize and filter content and messages
- Achieve compatibility with TRANSCOM and I-95 Corridor Coalition IEN
- Accommodate interfaces to other systems such as ADUS, advanced travel information systems (ATIS), and advanced traffic management systems (ATMS)
- Use a web-based GUI
- Incorporate GIS where possible and appropriate
- Consider value and strategy first, then technology.

These guiding principles fall into two distinct groupings: those that are forward-looking, aiming to achieve efficient information sharing in an integrated network, and those that require backward compatibility to avoid disrupting current operational systems.

The system will not immediately replace the established communication channels among agencies that are currently used to manage major incidents and events. The initial focus of RIMIS should be on supplementing and enhancing this communication by providing information and limited messaging capabilities. Over time, as the system is established and enhanced, some of the existing procedures and communications may become redundant.

To achieve the desired functionality with this capability and system, several constraints and issues must be addressed. The range of RIMIS partners, the complexities of multiple local interfaces, and variances in operational requirements from each of the partners drive the RIMIS CONOPS toward meeting the minimum requirements to satisfy the majority of the partners. The objective of the CONOPS is to illustrate, at a high level, what needs to occur to achieve the business objectives of participating agencies and what functionality users can reasonably expect from RIMIS; additional details will need to be worked through and agreed upon as the design progresses during later phases.
5.2 **OPERATIONAL POLICIES AND CONSTRAINTS**

Section 4 has outlined several potential constraints that could impact some of the desired features of RIMIS. Through the concept development process, several potential constraints have been identified from both policy as well as operational perspectives. RIMIS introduces a new dynamic and level of data and information sharing among agencies in the Delaware Valley that will require increased attention and possible revision to local and regional policies.

This subsection outlines potential constraints that are posed by the proposed design, concept, functionality, and potential users. Because of the local interface requirements, additional constraints should be anticipated depending on individual agency policies and requirements; these are more appropriately addressed as part of the requirements definition phase and on an agency-by-agency basis as part of the design and implementation phase.

**5.2.1 Potential Policy Constraints**

- Agencies have established processes and procedures for incident and event coordination, which have both operational and policy implications. For example, PEMA’s policy is to contact specific agencies individually depending on the incident or situation; this policy currently requires PEMA to manually contact and directly coordinate with the agency. Whether RIMIS messaging or message confirmations will fit within this policy will require PEMA’s review. Other agencies in the region may have similar policies that require them to manually confirm contact or information distribution.

- From a policy constraint perspective, areas of responsibility or jurisdiction, particularly for incident management, may overlap. Incident command processes are in place that govern how incidents are handled in the field by these agencies with jurisdictional overlap. By bringing these parties together through a common messaging infrastructure, RIMIS may produce duplicate or overlapping information in response to an incident or a request or, more appropriately, it can allow the associated overlapping procedures to be executed with a higher level of coordination.

- Because RIMIS will be using a decentralized architecture, it will require multiple local interfaces to communicate and extract data from agency systems. Policies, particularly from an information technology perspective, will require review at the agency level to determine appropriate interface requirements and logistics. Policies on data privacy, security issues, firewalls, and other related issues will also need to be addressed at the RIMIS level, with each agency contributing both manual and automated data.

- Agencies have established capital budgets, often long term, and budgeting/programming processes that might not easily accommodate near-term RIMIS budgeting needs.

- Localized policies, such as internet access, could prohibit or limit certain agencies from being able to access RIMIS at their agency.

- Agencies have requested a certain level of customization and filtering at their respective endpoints to be able to filter certain data, messages, or both. This presents a policy-related constraint, particularly from a liability standpoint, in that certain information and messages may not reach some recipients because of individual filters or settings.

- From time-to-time, agencies may undergo organizational restructuring or shifts in priorities and missions. Several agencies are developing information networks to share information internally and with a limited number of outside partners. RIMIS functionality (near-term and future) must be flexible to accommodate such shifts.

- Several agencies have expressed an interest in obtaining CAD data from 911 and other emergency dispatchers. Making CAD data and its format available may require overcoming legal and agency policy hurdles.
5.2.2 Potential Operational Constraints

- Agencies have requested a certain level of customization and filtering at their respective endpoints, to be able to filter certain data, messages, or both. This presents an operational constraint because filtering certain features or data will limit accessibility to full RIMIS functionality.

- Because they do not have a consistent, regional mapping and spatial referencing system, agencies in the Delaware Valley are currently using independent systems for their data/information/device display needs. A comprehensive regional map showing real-time status of transportation facilities or devices to be generated from various agency systems will require the region to adopt a standard map and configure the interfaces appropriately.

- Another operational constraint is the addition of new centers, new data sources/interfaces, or changes to agency systems or data that are already connected to RIMIS. Changes to data elements made at the RIMIS or agency level may impact the information content being shared.

- One constraint of the initial RIMIS implementation is the system will be accessible only via workstations at the participating agency centers. In-the-field personnel will not have access for viewing or providing information directly to RIMIS. Enhancements to RIMIS for consideration should include wireless remote devices to provide access to in-the-field personnel.

- Agencies have requested that RIMIS account for a single point of entry at each agency (for messages and data). A constraint or issue with a web-based GUI and the accessibility it offers may be that many people at an agency could access RIMIS simultaneously.

- Some agencies have expressed interest in full integration with their systems (i.e., no stand-alone workstation); others have expressed serious concerns about any RIMIS interface with their respective systems and may require a stand-alone workstation.

- To accommodate the GUI guidelines, local interfaces, and requested level of customization, some impact on existing agency software must be considered and accepted. Each agency will need to determine the extent of modification to its software that will be needed.

- The proposed system is decentralized, which poses some constraints because the design does not rely on a prominent central database but rather on a virtual database used by all of the agencies.

- Without a central staff to operate or maintain RIMIS, its stakeholders will rely on outside vendors for maintenance and support functions. Under this scenario however, agencies will still be required to provide management staff to oversee the performance of these vendors.
5.3 DESCRIPTION OF THE PROPOSED SYSTEM

The recommended approach for implementing RIMIS begins with an understanding that a phased and incremental implementation plan is critical to successful operations and ongoing use by RIMIS partners. A phased implementation provides users the opportunity to gain early experience with some of the functionalities of the system and learn how RIMIS supports their agency’s respective missions and operations. Based on this experience, users will be able to make informed judgments on adding new functionality to the system. In addition, a phased approach reduces the risk of creating a system that takes a long time to deploy and thus increases cost. A phased approach also enables stakeholder agencies to provide feedback at intervals, thus reducing the risk of deploying a system that does not meet the needs of the RIMIS stakeholder agencies.

Many RIMIS partner agencies in the Delaware Valley region have existing systems that are in the process of being integrated and in some cases expanded. The design and implementation of RIMIS needs to anticipate these expanded systems and advances in technology so that future operations can take advantage of new technologies and coordinated systems. In addition, the I-95 Coalition had developed initiatives that will update and possibly replace its existing IEN. RIMIS should be designed to take advantage of new initiatives within and outside the region.

This subsection provides an overview of the key facets and components of RIMIS, including:

- RIMIS Architecture (Section 5.3.1)
- Data and Standards (Section 5.3.2)
- Data Archiving (Section 5.3.3)
- Message Processing (Section 5.3.4).

5.3.1 RIMIS Architecture

The preferred RIMIS architecture is based on a distributed peer-to-peer network that is not dependent on any centralized components; a high-level representation is shown in Figure 5-1. This architecture provides for a designated node at each agency that will facilitate an interface to the RIMIS network for the purpose of sharing information and processing messages. The node will also provide a repository for agency-specific information that can be extracted from existing agency systems. With this localized interface feature, it is anticipated that the node will have at least a limited network connection to a portion of the existing networks of the RIMIS partner agencies to allow for the transfer of automated data.

The RIMISNet cloud depicted in Figure 5-1 represents a multi-point private network that enables RIMIS information to move between originating and consuming RIMIS organizations. This movement, or routing, activity occurs without a predefined route and can therefore provide infrastructure redundancy to increase reliability and optimize the performance of available computing resources. Physically the network can be established via a private communication company, linking various public sector communication assets to form a public RIMIS network (i.e., fiber networks) or a combination of both.

The initial RIMIS implementation should focus on the sharing of readily available data over a fully distributed network. Each agency will be responsible for the uploading or pushing of relevant data to be shared with other agencies, with the data residing on each agency’s node equipment. Providing data in an automated manner requires an interface between the RIMIS network and the equipment at participating agencies that are providing data.

A web-based GUI that enables the user to access RIMIS information through a web browser is recommended for RIMIS. This approach will reduce the proliferation of dedicated workstations, which has been a negative consequence of similar C2C projects in other areas. RIMIS needs to present data in a geographically accurate context that is facilitated by using GIS technology as part of the GUI. Information also needs to be displayed in text or tabular format.
5.3.2 Data and Standards

One approach to provision of agency data is to provide the information in an Extensible Markup Language (XML) formatted file. This approach is consistent with C2C protocol standards defined by the NTCIP committee. Standard Development Organizations (SDOs) are currently developing XML applications to encode the Traffic Management Data Dictionary (TMDD) and various ITS message sets standards; they have not been tested yet in a C2C application. In addition, this approach simplifies the task of presenting the data through a web-based GUI. The RIMIS Subcommittee should review the selection of XML as the recommended RIMIS format.

Other relevant standard protocols for C2C data exchange include Data Exchange in Abstract Syntax Notation (DATEX-ASN) and Common Object Request Broker Architecture (CORBA). DATEX-ASN supports a peer-to-peer architecture; however, this standard is older technology compared to XML. CORBA is better suited for connecting systems that were originally designed to support CORBA rather than as a retrofit.

To the extent feasible, RIMIS data should be organized according to approved and emerging NTCIP defined message sets containing elements defined in the TMDD and the incident management standard message sets contained in the IEEE 1512 standards. This will provide a degree of compatibility between RIMIS and other information sharing systems in the region. Other applicable standards include TCIP for transit operations, External Message Sets for Traffic Management Centers, Message Sets for Advanced Traveler Information Systems, and LRMS for linear referencing.
Appendix 10 to this CONOPS provides more information about appropriate standards that have been recommended, and in some cases already applied, to RIMIS development, implementation, and operations.

5.3.3 Data Archiving

Some of the data provided by RIMIS will be useful to store in an archive for subsequent analysis. Although not a primary function of RIMIS, archiving data can serve as a valuable output of the information, messages, and message sequences that will be exchanged through the new system. Analysis of messaging associated with major incidents and events can be useful when evaluating the operations of the system for future enhancements. Implementing a distributed archiving scheme consistent with the distributed architecture is one route to effective data archiving. Alternatively, the archiving function can be developed as a centralized function to be funded and controlled regionally while being operated and maintained by one of the partners.

5.3.4 Message Processing

In addition to sharing information, RIMIS needs to be capable of processing messages. Ideally, existing agency systems will generate these messages automatically, such as road condition reporting systems, CAD systems, and incident management systems. RIMIS also needs to support manual generation of messages from the various partners, including:

- Broadcast messages, alerts, and notifications
- Limited-recipient messages, alerts, and notifications (sent to a selected group or individuals for more specific communications).

In determining the type and mechanism for generating messages, a balance should be established between convenience and relevance. It may be convenient to automatically generate messages using a CAD system. If this results in a large number of marginally valuable messages, the recipient operators will tend to ignore them. Conversely, if generating a large number of messages manually becomes burdensome, operators may fail to initiate important communications. Filters at the receiving end can compensate when a large number of marginal messages are generated.

Until the traffic operation centers integrate their software, they will perform most of their operations manually, including inputting into RIMIS. RIMIS must be designed in such a manner to minimize double data entry. One way to partially solve this problem is for some agencies to temporarily adopt RIMIS as their official database.

5.3.5 RIMIS Components and Operating Environment

**Agency Data Sources**

To gain an understanding of how RIMIS can support agency information sharing and coordination, it is important to provide a baseline of available information that can be used to support decision making and coordination functions. Agencies and partners in the Delaware Valley have made a significant investment in infrastructure to provide real-time information about the status of the transportation network, and more systems are planned for the near term. Additional information, such as planned closures and maintenance activities and pre-planned traffic management strategies provide a regional picture of current and near-term impacts to the region’s network.

**Table 5-1** provides a summary of potential data sources and identifies potential users of the information. This table demonstrates the breadth of available information and agencies that will benefit from accessing both static and real-time information. In an ideal world, RIMIS will fulfill all the data sharing desires expressed in Table 5-1. Because of budgets and real-world constraints however, RIMIS will initially need focus on the subset of critical needs. Over time, RIMIS will be able to fulfill some of the secondary needs identified in the Table 5-1.
In interviews and survey responses, several agencies have expressed the need for planned closure information. RIMIS can address this need by broadcasting messages from state and local traffic management entities to other RIMIS users impacted by these planned closures.

During its initial implementation, RIMIS will not be able to contain all available information from all participating RIMIS partners. Relying primarily on agency use of the message-based capability and manual inputs, it will be able to provide a limited amount of agency operational information obtained from direct interfaces. As RIMIS expands and agencies realize and experience the benefits of enhanced information sharing and exchange, the amount of available baseline information that can be accessed by a broad range of agencies in the region will increase. Information also will increase as more of it becomes available directly from interfaces to key partners. The objective after the initial implementation is to minimize manual input.

Primary sources of available transportation network conditions information and those that should be considered as part of the initial RIMIS implementation are the following:

- New Jersey Department of Transportation (NJDOT), Traffic Operations South
- PennDOT, District 6-0
- Pennsylvania Turnpike Commission (PTC)
- New Jersey Turnpike
- Philadelphia Streets Department (planned operations center)
- DRPA (planned operations center)
- SEPTA
- Private traffic reporting services, including Traffic.com and Westwood One.

Note that the PTC and PennDOT are developing integrated system capabilities. The PennDOT system in District 6-0 provides considerable capability to share data using CORBA and XML protocols. NJDOT currently also has several independently operating systems that are in the process of integrating.
<table>
<thead>
<tr>
<th>Category</th>
<th>Agency Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Video</strong></td>
<td>RIMIS Concept of Operations (ConOps) Document</td>
</tr>
<tr>
<td></td>
<td>Plans/Releases Video</td>
</tr>
<tr>
<td></td>
<td>NJ DOT Traffic Center Video</td>
</tr>
<tr>
<td></td>
<td>Traffic Vessel源泉 Video</td>
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<tr>
<td></td>
<td>NJ Turnpike Data</td>
</tr>
<tr>
<td></td>
<td>ISFPA Traffic Center Video</td>
</tr>
<tr>
<td></td>
<td>PA Turnpike (Ancillary functions)</td>
</tr>
<tr>
<td></td>
<td>ISFPA Traffic Camera Data</td>
</tr>
<tr>
<td></td>
<td>Atlantic City Expressway (Traffic)</td>
</tr>
<tr>
<td></td>
<td>NJ Departments (Ancillary functions)</td>
</tr>
<tr>
<td></td>
<td>Sports Complex</td>
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<tr>
<td></td>
<td>heroin Surveillance Cameras</td>
</tr>
<tr>
<td></td>
<td>Video Control</td>
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<td><strong>Construction and Maintenance</strong></td>
<td>Planned Lane Changes</td>
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<td>Planned Maintenance Activities</td>
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<td>Emergency Maintenance Activities</td>
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<td><strong>Traffic Control</strong></td>
<td>CMS Status and Messages</td>
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<td>Traffic Signal Timing Plan</td>
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<td>Highway Advisory Radio Messages</td>
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<td><strong>Traffic Flow Data</strong></td>
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<td>Speed Data</td>
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<td>Occupancy Data</td>
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<td>Travel Time Data</td>
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<td>Full Data (UPLan)</td>
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<td><strong>Incident Management/Public Safety</strong></td>
<td>Road Crash Data by police</td>
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<td>CASI Dispatches</td>
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<td>Instant Traffic Warning</td>
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<td>Accident Notification Data</td>
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<td><strong>Events</strong></td>
<td>Event Location Data</td>
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<td>Event Schedule Data (Events, Incidents)</td>
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<td>Omni-Link Incident Information Data</td>
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<td>Event Traffic Control Plan</td>
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<td><strong>Road/Weather Conditions</strong></td>
<td>Surface Temperature Data</td>
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<td>pavement Condition</td>
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<td><strong>Transit</strong></td>
<td>Schedule Affiliation (ATS) Data</td>
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<td>Vehicle Positioning Data</td>
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<td>Transit Incident/Public Safety Data</td>
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<td><strong>Weather</strong></td>
<td>Equipment Weather</td>
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<td><strong>Emergency Alerts</strong></td>
<td>EMS Alert Data (Emergency, Evacuations)</td>
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<td>NREEMS Emergency (DR)</td>
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<td>NJ Emergency (DR)</td>
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<td></td>
<td>Emergency Plane</td>
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**Table 5-1. Agency Data Sources**

*Notes: *X indicates data is used.*  
*BLUE CATEGORIES INDICATE RIMIS RELATE PRIORITY FUNCTIONALITY*
The Philadelphia Streets Department currently operates an Advanced Transportation Management System primarily for traffic signal monitoring and control. Plans have been developed to add CCTV cameras, dynamic message signs (DMS), and vehicle detectors in the future will provide additional information on arterial operations within the city. The Delaware River Port Authority does not have a traffic management system, and a recent design initiative for a system has been placed on hold. SEPTA operates a number of different Supervisory Control And Data Acquisition (SCADA) systems for its various modes of transit. Its two systems most likely interconnect with RIMIS are the bus operations and police dispatch. At present, information from all agencies about conditions, incidents, or closures must be manually entered.

In addition to transportation management agency data providers, the Pennsylvania State Police, the New Jersey State Police, and the Philadelphia Police Department are potential sources of information and alerts to be accessed through an interface to their respective CAD systems. New Jersey State Police recently opened a centralized joint dispatch center with NJDOT and New Jersey Department of Environmental Protection. Pennsylvania State Police is consolidating their 81 dispatch centers to five consolidated dispatch centers, with the center in Norristown responsible for covering the Delaware Valley region. The PTC also operates a CAD system.

Pennsylvania State Police has been in discussion with the PennDOT central office about sharing its Incident Information Management System (IIMS) data, and PEMA has held similar discussions with PennDOT about sharing its Port Import Export Reporting Service (PIERS) data. Traditionally law enforcement agencies have been reluctant to allow its public safety CAD systems to provide a direct interface to the systems of other agencies, such as DOT or regional IENs, in order to exchange data. Delaware Valley law enforcement agencies are consistent with their peers in this respect. Obvious public safety agency concerns and issues emerge wherever a direct interface to CAD systems is discussed. Issues related to providing direct interface from outside systems to be considered include information privacy (e.g., HIPPA requirements), security, and accessibility, as well as public safety call-outs other than those that impact the transportation network.

5.3.6 Information Processing

**Incident Information**

Incident information processing capabilities of RIMIS are guided by the anticipated information tracking function described in Section 4.2.1. A central feature of this function is the generation of message logs for incidents. RIMIS information processing capabilities will constantly update these message logs. The message alert and initiation feature of the incident tracking function will also be facilitated by the incident information processing capabilities of RIMIS. Plans for this capability include a customizable user configuration to automatically select information relevant to a jurisdiction, users class, and other types of criteria.

**Planned Closures and Events**

Agencies in the Delaware Valley responsible for transportation, law enforcement, transit, and related areas cooperate and coordinate in proactively planning traffic management strategies for events. As in incident management, cooperation and strategic coordination is fragmented and relies upon interpersonal contacts built up over time. As an information sharing and messaging mechanism, RIMIS can serve as a valuable tool not only for core agencies directly involved in event transportation issues/logistics but also for other agencies that need to be aware of planned closures, events, construction, and other activities to assess whether they will make an impact on their operations. RIMIS will be able to provide information on the following planned closures and events:

- Maintenance activities
- Construction
- Special events requiring modifications to transit service and road restrictions, closures, or detours (e.g., parades, sporting events, and festivals)
- Security restrictions for events or specific locations.
Potential inputs to RIMIS to support planned closures and events and corresponding traffic management strategies throughout the region include information primarily from traffic management (e.g., state DOTs, City of Philadelphia and other municipalities, and turnpikes) and transit agencies (e.g., planned detour or route deviations). It is suggested that regional event information can be input by the Sports Complex, Philadelphia Convention and Visitors Bureau (PCVB), and the various regional TMAs. State and county police departments that are managing traffic for such events can update the information.

Both automated and manual inputs will be required to obtain the necessary information. Automated interfaces will apply to those items that are likely to be available from existing databases or systems. Many database management systems, such as ORACLE and SQL Server, have built-in capabilities to export and import data to XML formatted files. In some cases, manual inputs will be required, including event schedules, special security updates, parking management plans, and other pertinent and event-specific information. It is critical that this database be constantly updated and verified to ensure agencies are providing real-time information to motorists. Reminders for updates prior to scheduled start times will also be necessary for operators to determine if planned maintenance and construction activity are actually going to take place as planned. RIMIS will generate similar reminders automatically to determine if planned road closure and event activities are terminated as per their scheduled closing times.

Roadway Conditions

Roadway conditions information will include the following:

- Traffic flow data including speed and volume
- Weather-related conditions and hazards, including rain, flooding, ice, and high winds
- CCTV images.

Freeway and arterial control systems typically collect traffic-flow data and store this data in a database management system. This allows data to be exported from the database management system into XML formatted files in a manner similar to that anticipated for obtaining schedule data. This approach minimizes the effort required to modify the existing freeway and arterial control systems. Travel-flow data can be generated in two different formats: spot speeds measured by real-time management system (RTMS) sensors and link speeds produced by TRANSMIT or other probe technologies. Because of the way traffic speeds and flow are measured, the two sets of data must be handled independently and represented in a different manner on the GUI.

Potential sources of traffic-flow data include the following agencies, with the status of their respective traffic flow data program appearing in parentheses:

- NJDOT (future)
- PennDOT, District 6 (limited coverage)
- PTC (limited coverage)
- New Jersey Turnpike (limited coverage)
- Philadelphia Streets Department (future)
- Delaware River Port Authority (future)
- Delaware Department of Transportation (DelDOT) (future)
- Traffic.com (existing).

Weather-related conditions are monitored using Remote Weather Information Systems (RWIS). These systems detect conditions such as fog, icing, rainfall, and flooding. Typically, RWIS monitoring software is supplied by the sensor vendor, which requires an interface to various RWIS systems to make this information available through RIMIS. NJDOT, PennDOT, and the PTC are among the agencies currently operating an RWIS. Other weather information will be available via a feed from the National Weather Service or other weather reporting entity.

Agencies have a strong interest in obtaining camera images on a regional basis. The technology to support this capability ranges from streaming video in real time to periodic snapshots of cameras. Full streaming video for a large number of cameras will create a significant bandwidth requirement and a
dedicated video transport network. Employing IP-addressable cameras that use the Internet as the transport media to obtain full streaming video is an alternative to building a private network. Currently, few cameras in the region are IP-addressable and implementing a sufficient number of cameras for regional video data sharing may take a few years for this capability to be a feasible RIMIS system feature. This problem can be addressed by developing a regional video sharing program independent of RIMIS, then integrating the program’s video into the RIMIS GUI.

Potential sources of CCTV camera images include the following agencies. (Agencies with either no existing cameras or very limited coverage are indicated in parentheses)

- NJDOT
- PennDOT
- DRPA
- PTC (limited coverage)
- New Jersey Turnpike Authority (NJTA) (limited coverage)
- South Jersey Transportation Authority (SJTA) (limited coverage)
- Philadelphia Streets Department (future)
- Philadelphia Sports Complex (future)
- Delaware River and Bay Authority (DRBA)
- Delaware River Joint Toll Bridge Commission (DRJTBC)
- Burlington County Bridge Commission (BCBC)
- DelDOT
- Traffic.com
- Westwood One.

**Device Status**

Device status feature will enable RIMIS to provide information on the operation of field devices currently controlled by agencies in the region. Of primary interest is the status of DMS, including the ability to determine the currently displayed messages. DMS vendors often provide DMS control systems that do not have the ability to share information across a C2C platform. This capability will likely require some modification to existing DMS control systems to make this information available to RIMIS. Fortunately, many agencies are integrating traffic operation center software to reduce or eliminate the proprietary workstations needed to drive VMS and HAR devices.

Identifying HAR devices that are currently active and the kind of information that is being broadcast using them may be of value for agencies interested in HAR status. The equipment vendor usually provides HAR systems, and the software has limited capability to interact with regional systems. Consequently, significant effort may be required to obtain HAR status for RIMIS.

Potential sources of device status include the following agencies:

- NJDOT
- PennDOT
- PTC
- NJTA
- DRPA
- Philadelphia Streets Department (future)
- DelDOT
- SJTA
- Philadelphia Sports Complex (future).

5.3.7 Message Processing and User Interface

Another major function of RIMIS is to provide a mechanism for transmitting messages among operators at different agencies. To the extent feasible, these messages will be generated automatically by existing systems such as CAD and incident management systems. RIMIS will need functionality that enables
manual messaging or notifications; in the initial implementation, the majority of messaging will rely on operator-initiated messages.

RIMIS can provide continuously updated information that is of common interest to the partner agencies. To the extent feasible, the information should be automatically generated by the source agency and made available to other agencies through the RIMIS GUI.

Managing information within RIMIS is based in the following assumptions:

- XML files will be used to provide data to a web-based user interface.
- To the extent feasible, XML files will be generated directly from existing database tables.
- Database tables may be used for temporary storage of dynamic data and will serve as the source for XML formatted files.
- Metadata will be used to cross-reference data between data sources and the web-based user interface.

**Figure 5-2** indicates the recommended approach to processing data sources automatically. Data is extracted either from existing agency databases or existing agency systems. Database data is joined with metadata that is stored in the node equipment. The joined data is then converted to XML formatted files for distribution over the RIMIS network.

Data that is extracted from existing agency systems can either be joined directly with metadata or stored in a temporary database that is then joined with the metadata to produce XML-formatted files. This temporary database may facilitate a more cost-effective solution for modifying existing systems and may fulfill agency and RIMIS needs until more permanent traffic operation center (TOC) software is developed.

Potential sources of messages will include information related to roadway incidents, major events, and Amber alerts. Each message should consist of the following elements:

- Time stamp
- Source agency/Department
- Priority
- Content (i.e., message text consistent with various ITS message standards)
- Recipient list.
Graphical User Interface

The issues on the RIMIS GUI to be considered do not concern industry standards, but rather design approaches to meet the needs of RIMIS and its partner agencies. These issues include:

- Minimizing double-entry of data by ensuring that data entered at an agency GUI in support of the agency’s own operations will not require re-entry of the data for the benefit of RIMIS
- Making minimal or no impact to current agency software and operations
- Using web-based GUI and GIS implementations.

Avoiding double entry has already been identified as part of the conceptual RIMIS database architecture. Relevant data entered into an agency’s system via the agency’s GUI can be stored to the agency database and then screened for a database to be shared with RIMISnet at the agency’s RIMIS node. This requires only one data entry session by an agency operator; however, some new software must be provided at the agency end to collect the data and submit it to RIMIS. The specifics as to how this might be implemented depend on many factors, including:

- The current designs of individual agency GUls
- Database, network, and server software
- The willingness of partner agencies to make modifications to an existing system.

The RIMIS concept is based on a web-based GUI, which has distinct advantages over a windows-based GUI:

- Web browsers are readily available on most workstations and do not require the development or installation of new software at the workstation site.
- Creating or modifying screens for a web browser usually requires less effort than the development of windows-based screens.
- Because browser screens are developed in conjunction with data stored in a database, creating or modifying content can be performed from a central development site and can be readily accessible at participating RIMIS workstations simply by visiting the appropriate URLs (websites). Data communication between a user’s browser and the RIMIS site server can be conducted securely over a dedicated network or via a virtual private network using the Internet.

A typical Internet-based GUI is implemented by retrieving data directly from a database and populating a pre-designed webpage with information tailored to a user’s momentary or situational needs. Incorporating GIS is consistent with the Internet-based approach because data derived from a database is used to display information with a GUI. GIS will enable display of RIMIS information graphically and spatially by overlaying it on a regional network map. As maps are developed to display incident, construction, and VMS locations, they can be designed to accommodate capabilities and enhancements planned for future implementation, such as the dynamic display of travel times and traffic volumes.

A typical implementation uses a central database that acts as a repository of system information; however, the RIMIS proposed distributed architecture design concept demands that the system design does not rely on a prominent central database used by all of the RIMIS partner agencies. This requires that information shared within the RIMIS community must be transferred from a source agency to several users through the RIMIS net nodes, and then to be shared via the RIMISnet.

Data submission to RIMIS by partner agencies can be accomplished using the following methods:

- Modifying agency server software to enable transmitting data to the RIMIS communication network
- Using a stand-alone software package that eavesdrops on the agency network to glean information to be shared with the RIMIS community
• Using agency software to put shared data into the agency database, and using a RIMIS-related software package to read the data and place it on the RIMIS communication network.

**Information Displays**

The RIMIS GUI needs to provide information in a geographically intuitive format and provide schedule, bulletin, and other notifications in text format.

The typical approach to provide information geographically is to use a GIS map with icons to display information, as shown in the Figure 5-3 sample. The map will provide roadway and landmark data in a manner that clearly provides visual reference without being cluttered. The operator will be able to configure the map by selecting specific layers to display. In addition, the operator can zoom and pan the map to display specific areas within the region. Roadway information including speed and volume data should be displayed. Speed data collected from RTMS devices is only valid for specific locations and should not be assigned to a roadway link. The more densely devices are deployed and connected to RIMIS, the more accurate this travel picture will become in the GUI. If an accident occurs, RTMS devices will not notice the change in travel speeds until congestion spills back to the sensor location. For this reason, link speeds from vehicle probes and RTMS detectors must be treated differently by the RIMIS information processing capabilities. The map display feature assumes that real-time volume information is readily and consistently available for major freeway/expressway corridors throughout the region.

It is expected that the RIMIS software and system will give users a limited ability to query multiple databases and to display layers. If needed, customized GIS applications can be developed to provide a robust GIS capability. Note that this capability on RIMIS will require significant development effort because an effective map display will rely on consistent, real-time information that potentially many agency partners will make available to RIMIS. At present, real-time travel speed and traffic volume data is not currently available. Several public agency and private data providers are the potential information sources of congestion, speed, and volume data for the region’s freeways, expressways, and major arterial roadways. As agencies and firms obtain real-time traffic-flow information and make it available to RIMIS, the maps can be populated with traffic-flow information.
Actual construction and maintenance projects can be indicated on the map using an icon located on the roadway segment that is under repair. Selecting this icon will provide the operator with a description of the project, including the extent and expected duration. In addition, the source agency and contact information should be provided on the display. Each icon can be placed on the map using milepost or intersecting roadway information provided by each agency. Conversion of the data into latitude/longitude will be automatic as they are displayed on a map projection that already has the mileposts and intersection referenced in latitude/longitude. An automatic “geo-coding” of the data occurs at the point that the data are in the RIMIS-accessible database and processed by the mapping program, using the milepost and duration “start” and “end” fields as the reference fields for the geo-coding script.

Objects that constitute a normal part of the region’s infrastructure, such as police and fire stations, hospitals, and train stations can be geo-coded to appear in the map based on their latitude and longitude. These object classes or types can be identified and entered into the GIS database during the RIMIS development effort. They can be modified so that, for example, a new police station can be added, a facility can have its location changed, or a fire station "object" can be removed should the actual facility be shut down. The development effort will require that all types of users to identify those infrastructure objects required for the effective completion of their activities. A list of the types of attributes that can be mapped include:

- ITS asset locations (e.g., CCTV, VMS signs, HAR devices, detector locations)
- Passenger rail lines (e.g., heavy rail, light rail, commuter lines)
- Major bus routes
- Intermodal facilities (e.g., passenger terminals, freight terminals)
- Political boundaries (e.g., state, county, municipal boundaries)
- Official detour routes
- Support facilities (e.g., highway maintenance yards, police stations, fire departments, hospitals)
- Incident management asset locations (e.g., stand-pipe locations, person-doors in sound walls, turnpike access maintenance gates, median barrier gates/openings)
- Truck restrictions
- Aerial photos.

NJDOT currently provides both map and text information for incidents on its freeway and highway facilities. Figure 5-4 shows a screen from the NJDOT website (note this website also is intended for the public to access travel information; therefore, details are limited to location and impact). Because RIMIS will be limited to secure access by public agencies, more detailed information or contact information could be included for specific incidents or events.

Schedule information on planned events, maintenance, and construction should be presented using a comprehensive calendar that indicates the occurrence of a scheduled construction project, major event, or both. This information will be obtained from various agencies, such as PennDOT, NJDOT, DRPA, City of Philadelphia, and the toll roads and bridges in Pennsylvania and New Jersey. DVRPC already collects and consolidates this information and provides a text-base calendar of major construction projects, events, and activities that will affect the region’s transportation facilities, as shown on the DVRPC website’s TravelSmart link (www.dvrpc.org/transportation/commuter/travelsmart.htm). This calendar is currently consolidated on a by-agency basis. Developing a calendar on a per-day basis allows operators to select a specific day from the calendar and obtain a comprehensive list of scheduled activities throughout the region, including a description, agency source, and contact information.
RIMIS can make CCTV images available by clicking a camera icon located on the map. The display will provide a streaming video display or snap-shot image depending on the type of data available. Snap-shot data should be automatically updated to reflect the most recently captured image. Incorporating CCTV camera locations into the map makes selecting the most appropriate camera to view a specific accident or traffic jam easier for agency users.

**Message Processing**

The capability to process messages within RIMIS is analogous to the operation of an e-mail system. When a user creates a message related to an event, RIMIS will distribute the message to all of the users identified in the appropriate recipient list. The message will pop-up on each recipient’s inbox with the time stamp, sender, and subject identified. A high-priority message will be indicated by a visible alert, such as a red flag or flashing header.

The user will view the details of the message by opening the message. A high-priority message can generate a receipt to the sender to verify the message was received and read. Archiving these messages over time can be used to subsequently analyze message flows that will help determine the effectiveness of the messaging for various scenarios.
5.4 Modes of Operation

RIMIS will support a many types of agency information sharing needs during various types of events, ranging from typical day-to-day system operations, to planned events, and to multi-agency incident management and coordination. As demonstrated by the RIMIS Operational Scenario Workshop held on January 27, 2005, the most integral functions of RIMIS will be the multi-agency information sharing, broadcast message capability, and real-time messaging during incidents or other major disruptions on the region’s transportation network.

RIMIS will provide 24x7 access and functionality. Information generated by agencies not operating on a 24x7 basis will still be viewable through RIMIS however, their information may be of limited use during (their) after-hours.

This document describes three significant modes of operation related to the functionality of RIMIS:

- Normal (day-to-day) operations: This refers to activities performed during the course of a normal business day. “Normal” implies that neither significant incidents nor events are affecting the RIMIS constituent agencies.
- Operations during planned events: This results from the occurrence of one or more major scheduled events (e.g., special events, planned construction or closure, or prolonged detour/restriction) that significantly impact the region’s transportation network and involve multiple RIMIS partner agencies.
- Operations during incidents: This refers to operations that occur during the course of one or more major unplanned incidents that impact the region’s transportation network and multiple RIMIS partner agencies.

5.4.1 RIMIS Functionality to Support Day-to-Day Operations

For daily operations, RIMIS will provide a baseline information snapshot of transportation conditions on major corridors in the region. Day-to-day functionality will rely on automated interfaces to transportation management, transit, and private partners to access current information. This information will detail planned closures and restrictions resulting from maintenance activities, congestion information, weather, and other routine data, either static or near real time. Day-to-day functionality assumes traffic patterns and congestion levels consistent with the normal operations and usage of the region’s road and transportation network. This mode of operations includes minor incidents that have a minimal impact on other agencies.

Inputs will come from a variety of agencies (as shown in Figure 5-5), and the amount of input is scalable based on the interfaces at the local level with the RIMISnet nodes at participating agencies. Agencies will be responsible for configuring this interface, and they will predetermine the data/information that will be submitted to RIMIS.

This mode of functionality allows users to:

- View and monitor information stored in RIMIS
- Query for specific segments of the transportation network, specific events, and other information
- Better manage and direct efforts within their functional area based on regional, accessible information.
Information will be available through the RIMISnet interface at each agency, and users and operators will be able to view current activities, view and zoom in on the status map, and query the database for specific information.

5.4.2 RIMIS Functionality to Support Planned Events Scenarios

In addition to day-to-day operations, RIMIS will help agencies better plan for near-term, known impacts to the region’s transportation system. Planned events, in the context of transportation management, include:

- Planned lane closures and restrictions resulting from maintenance, construction, and other activities that are set to occur at a specific time and for a pre-determined duration
- Special events that restrict portions of the transportation network or corridors, such as parades or festivals, for a specified time and duration
- Special events that require unique traffic control/management strategies, such as at the Sports Complex
- Unique schedules for transit/public transportation services in response to planned special events.

As a data storage and information sharing mechanism, RIMIS serves as a valuable tool for agencies directly involved in event transportation issues/logistics and as an information tool for other agencies that may need to be aware of events, construction, or other activities to assess potential impacts to their own operations. Real-time traffic and transit information during events is currently available on an ad-hoc basis. RIMIS can more systematically provide this information to both a larger number of agencies and to the event organizer.

Figure 5-6 shows potential inputs to RIMIS to support planned events and corresponding traffic management strategies at the Sports Complex. The same concept can be applied to other event venues throughout the region. In this schematic, both automated and manual inputs will be required to obtain the necessary information. Automated interfaces, as discussed in the day-to-day operations model shown earlier, will apply to those items that are likely to be available from existing databases or systems. Manual inputs will be required for event-specific information such as event schedules, special security updates, and parking management plans.

Figure 5-5
RIMIS System Inputs to Support Day-to-Day Operations
For planned special events, the RIMIS messaging function will allow agencies to initiate messages, request information, request status, and other inquiries. Ideally, information about events, closures, traffic restrictions, and related items will be shown graphically on the regional map and in tabular/narrative format.

5.4.3 RIMIS Functionality to Support Operations During Incidents

RIMIS functionality and messaging will peak during incident conditions since frequent updates, notifications, alerts, and other messaging functions is most needed under these conditions. An incident on one of the region’s primary corridors, such as I-95, I-76, bridge crossings, expressways, turnpikes, and major arterials, will warrant distributing notifications, status updates, and impact details (e.g., “lane blockage”) to many agencies. Currently, much of the coordination during incidents is managed manually requiring multiple phone calls and faxes to be distributed among DOTs, local police, and state, city, and other local authorities.

The extent to which RIMIS can automatically extract updated incident information from public safety CAD systems will be determined during the design phase. Extracting this information requires multiple customized interfaces based on the various CAD systems currently operating in the region. Even if these interfaces can be addressed on a technical level, significant institutional barriers must be overcome to automate this kind of information exchange. Until CAD data become available, manual input of incident information pertaining to the transportation system may be necessary.

Incident conditions have the potential to impact numerous agencies, transportation facilities, and agency functions. Data sources for incident, status, actions taken, or directives issued can include many more agencies within the Delaware Valley region as well as outside of it. Figure 5-7 shows the potential data sources and types of information that RIMIS partners may be expected to provide, or may need to request, in the event of a major incident.

RIMIS with its broadcast message capability will allow agencies to:

- Notify RIMIS partners about an incident that’s been reported
- Transmit current, important details about a significant impact on the region’s transportation network to numerous other agencies
- Provide video of incident location and surrounding roadways
- Request specific agency responses or actions
- Request status of devices, closures and detours
• Request responses to requests
• Provide status updates as to expected duration of incident and impact on traffic
• Notify that incident has been cleared
• Broadcast to all partners, a selected group, or an individual agency.

As demonstrated during the RIMIS Operational Scenario Workshop, the capabilities, functions, and features of RIMIS will provide the most benefit to agencies during incidents that impact a significant corridor for a substantial amount of time. RIMIS ordinarily would make basic information on day-to-day activities or information from the planned event data pool available on the transportation network. In the event of a major incident, RIMIS could make new types of information from new sources available. For example, RIMIS could capture manually and automatically generated real time information from state and local police, CAD systems, emergency management offices in Pennsylvania and New Jersey, and other key agencies involved in emergency response activities. Figure 5-7 shows both automated and manual inputs to RIMIS that are envisioned during incident conditions in the region.

Unlike the day-to-day or planned-event modes, incident conditions require a capability to inform partners about rapidly changing conditions, request urgent responses to current conditions, and conduct other near real-time activities. As such, much of the information exchanged through RIMIS pertaining to incidents will rely largely on manual inputs or responses.

Figure 5-7
RIMIS Data Inputs during Incident Conditions

* - indicates manual input
5.5 **USER CLASSES AND OTHER INVOLVED PERSONNEL**

Since RIMIS is a regional system that offers information sharing between participating organizations, diverse user classes and end users will benefit. The user class is a means to categorize the end users by position responsibilities and interaction with the system. Each user class will have unique data needs and sources of data to achieve their job requirements, thus making the regional nature of RIMIS significant. User classes may include the following positions within an organization:

- Operations and maintenance management personnel
- Control center/Dispatch center managers
- Operators/Dispatchers
- Information technology staff
- Emergency management authorities
- Public safety operators/dispatchers
- Emergency response/Law enforcement personnel
- Public affairs/Community relations
- Program management and administration staff
- Information service providers
- Outside vendors.

Different levels or parts of organizations will be responsible for different pieces of the information chain, including information dissemination. This will vary according to agency protocol. In some agencies an individual operations center dispatcher would place a notification call to another affected agency; in other organizations, the notification call must be approved by a supervisor before being communicated to outside agencies. Since many agencies are conscious of their Internet “presence”, some agencies may require that messages indicating trouble be reviewed by a Public Affairs officer before they are communicated. Except in small operations or during low-volume hours, it would be unusual for one person to be expected to perform all of the agency’s notification of delay or disruption to other agencies. Also, because of the high number of potential users, multiple locations within any single agency may want access to RIMIS.

A more complete profile of each user class was given in Section 3.5. The relationship between agency categories and user classes are mapped in Table 5-2.

The following list identifies agencies expected to participate in RIMIS:

- **Transportation Providers/Traffic Operation Centers**
  - New Jersey Department of Transportation (NJDOT) – Traffic Operations South
  - Pennsylvania Department of Transportation (PennDOT) – District 6-0
  - Delaware River Port Authority (DRPA)
  - Philadelphia Streets Department
  - New Jersey Turnpike Authority (NJTA)
  - Pennsylvania Turnpike Commission (PTC)
  - Delaware Department of Transportation (DelDOT)
  - Delaware River and Bay Authority (DRBA)
  - South Jersey Transportation Authority (SJTA)
  - Philadelphia International Airport
  - Burlington County Bridge Commission (BCBC)
  - Delaware River Joint Toll Bridge Commission (DRJTBC)
  - New Jersey Department of Transportation Statewide Traffic Operations Center
  - PennDOT Statewide Traffic Operations Center
  - Philadelphia Sports Complex Special Services District
  - Select Port of Philadelphia Marine terminals and rail terminals
  - Select county/municipal traffic operations centers

- **Transit Management Centers**
  - Port Authority Transit Corporation (PATCO)
Southeastern Pennsylvania Transportation Authority (SEPTA)
New Jersey Transit
Amtrak

**Emergency Management Agencies**
- New Jersey State Police
- Pennsylvania State Police
- Philadelphia Fire Department
- Philadelphia Police Department
- Philadelphia Traffic Police, Radio Room
- Delaware State Police
- County emergency management agencies/911 systems
- New Jersey Office of Emergency Management (OEM)
- Pennsylvania Emergency Management Agency (PEMA)
- Select municipal police/fire departments

**Program Administration**
- Delaware Valley Regional Planning Commission (DVRPC)
- Federal Highway Administration (FHWA)
- Federal Transit Administration (FTA)

**Information Service Providers**
- Bucks County Transportation Management Association (TMA)
- TMA of Chester County
- Cross County Connection TMA
- Delaware County TMA
- Greater Mercer TMA
- Greater Valley Forge TMA
- The Partnership TMA
- Traffic.com
- Westwood One (Metro/Shadow Traffic, SmartRoute)
- Other select media (to be determined)

**Other Organizations**
- TRANSOCOM
- I-95 Corridor Coalition
- Philadelphia Center City Business District
- Philadelphia Convention and Tourist Bureau.

### 5.5.1 Organizational Structure

RIMIS is a tool that will support multiple agencies in their respective operational missions and objectives. As a regional resource and as a decentralized system, RIMIS does not require a formal organizational structure to govern implementation, operations, enhancements or the interactions among the various RIMIS partners, or the RIMIS partnership. **Figure 5-8** shows the relationship of the various RIMIS partner agencies, including data providers, various data users, and program administrators. These relationships may shift or change over time as RIMIS is implemented and as enhancements are phased in.
Within each of the participating agencies or types of organizations, RIMIS will require different types of potential users, ranging from operators, dispatchers, public affairs and community relations staff, and technical resources to help the system function and operate at the local levels. **Table 5-2** shows the agency categories and the user classes. Note that some variations will emerge among some of these user classes depending on the agency and how the individual agencies are structured. This table shows a high-level, general view of typical user classes. In reality, some operation centers co-mingle different functions, such as traffic operations and public safety, while others decentralize functions around geographic areas.

**Table 5-2**

<table>
<thead>
<tr>
<th>Agency Category</th>
<th>User Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Operation Centers</td>
<td>• Operations and Maintenance Management Personnel</td>
</tr>
<tr>
<td></td>
<td>• Control Center/Dispatch Center Manager</td>
</tr>
<tr>
<td></td>
<td>• Operators/Dispatchers</td>
</tr>
<tr>
<td></td>
<td>• Information Technology Staff</td>
</tr>
<tr>
<td></td>
<td>• Public Affairs/Community Relations</td>
</tr>
<tr>
<td></td>
<td>• Outside Vendors</td>
</tr>
<tr>
<td>Transit Management Centers</td>
<td>• Operations and Maintenance Management Personnel</td>
</tr>
<tr>
<td></td>
<td>• Control Center/Dispatch Center Manager</td>
</tr>
<tr>
<td></td>
<td>• Operators/Dispatchers</td>
</tr>
<tr>
<td></td>
<td>• Public safety operators/dispatchers</td>
</tr>
<tr>
<td></td>
<td>• Information Technology Staff</td>
</tr>
<tr>
<td></td>
<td>• Information Service Providers (Note that traveler information for transit Internet and telephone systems are inputted by public affairs staff and control room operators, not by information service providers)</td>
</tr>
<tr>
<td></td>
<td>• Public Affairs/Community Relations</td>
</tr>
<tr>
<td></td>
<td>• Outside Vendors</td>
</tr>
<tr>
<td>Agency Category</td>
<td>User Classes</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Emergency Management Agencies         | • Emergency Management Authorities  
• Public Safety Operators/Dispatchers  
• Emergency Response/Law Enforcement Personnel  
• Information Technology Staff  
• Public Affairs/Community Relations  
• Outside Vendors                     |
| Information Service Providers         | • Public Affairs/Community Relations  
• Information Service Providers  
• Information Technology Staff  
• Outside Vendors                     |
| Program Administration                | • Program Management and Administration Staff                                 |
| Other Organizations                   | • Operations and Maintenance Management Personnel  
• Operations/Control/Dispatch Center Management  
• Operators/Dispatchers  
• Information Technology Staff  
• Public Affairs/Community Relations  
• Information Service Providers  
• Outside Vendors                     |

### 5.5.2 Profiles of RIMIS User Classes

This section of the CONOPS provides an overall description and profile of the key user classes and types of staff positions that will have direct interaction with RIMIS and describes the types of interactions anticipated with RIMIS. **Table 5-3** represents a top-level range of duties and system interactions; some of these descriptions may vary from agency to agency.

#### Table 5-3

**User Class Interactions with RIMIS**

<table>
<thead>
<tr>
<th>User Classes</th>
<th>Interaction with RIMIS</th>
</tr>
</thead>
</table>
| **Operations and Maintenance Management Personnel**               | • Use RIMIS data and information for decision-making purposes, coordinate resources, and direct staff in responses to specific events or requests  
• Exercise direct supervision over professional and technical staff that will be entering information or accessing information from RIMIS  
• Use data such as construction/maintenance schedules, traffic control messages, road closure information, special events, and emergency alerts to coordinate operations and maintenance activities with neighboring entities and implement diversion strategies as needed. |
| **Control Center/Dispatch Center Managers**                      | • Identify user and source of data within RIMIS  
• Monitor operating conditions and works with the controllers/dispatchers to create accident notifications or maintenance requests through RIMIS as needed. |
<table>
<thead>
<tr>
<th>User Classes</th>
<th>Interaction with RIMIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operators/Dispatchers</strong></td>
<td>• Monitor and operate agency systems and input and initiate RIMIS communications as conditions warrant</td>
</tr>
<tr>
<td>• Responsible for monitoring internal agency systems and operations</td>
<td>• Input data directly into RIMIS and monitor, extract, and interpret data from RIMIS for potential response.</td>
</tr>
<tr>
<td>• Notify other staff, supervisors, internal and external departments, and appropriate authorities of adverse conditions requiring a response</td>
<td></td>
</tr>
<tr>
<td>• Coordinate with fleet or field personnel</td>
<td></td>
</tr>
<tr>
<td>• Provide coordinated response to traffic and incident issues by dispatching appropriate resources</td>
<td></td>
</tr>
<tr>
<td>• Troubleshoot system operations.</td>
<td></td>
</tr>
</tbody>
</table>

| Information Technology Staff      | • Are not directly involved in entering information to RIMIS or using information from the system |
| • Responsible for implementation, repair, and maintenance of agency communications equipment and infrastructure and databases. | • Are key in maintaining the communication networks to ensure data and information flows from the agency data systems to RIMIS |
| • Assess system operations, databases, and networks to troubleshoot potential system errors | • Coordinate appropriate interfaces between RIMIS and agency databases and systems; monitor interfaces and troubleshoots when necessary; and facilitate RIMIS access through agency firewalls. |
| • Specify, procure, and installs, telecommunications infrastructure to support agency operational objectives and functions |                                                                                           |
| • Implement appropriate network security measures consistent with agency policies. |                                                                                           |

| Emergency Management Authorities and Public Safety Operators/Dispatcher Managers | • Use RIMIS construction schedules, emergency alerts, public safety notifications, weather, and roadway conditions, and other features |
| • Consist of regional, state, and county entities responsible for ensuring the safety and security of employees and the general public | • Initiate notifications through RIMIS about major emergencies or hazards, responses, and direct actions. |
| • Evaluate existing security programs and plans for security enhancements that are compliant with state and federal regulations | • Use RIMIS capabilities to provide emergency alerts and directions to the public via VMS signs and HAR devices. |
| • Establish protocols for large-scale emergency notification, response and multi-agency coordination. |                                                                                           |

| Public Safety Operators/Dispatchers | • Input incident information to RIMIS and initiate appropriate notification messaging (respecting that RIMIS does not supersede established protocols for incident management notification and coordination between Public Safety Answering Points and emergency responders) |
| • Include 911 operators at the various 911 call centers and dispatchers at police, fire, and other emergency responder communications facilities | • Use RIMIS video, traffic speeds, and construction information to determine how to route emergency responders to an incident site and to implement detours. |
| • Primarily responsible for answering emergency calls and dispatching them to the appropriate emergency response agency |                                                                                           |
| • Initiate CAD logs for incidents, including initial call, incident details, dispatch details, and updates. |                                                                                           |

| Emergency Response/Law Enforcement Personnel | • Provide information and updates to the public safety operators and dispatchers who then update RIMIS |
| • Include police, fire, ambulance, and other emergency response staff from the states, cities, counties, toll authorities, transit agencies, and related organizations. | • Do not interact directly with RIMIS during initial implementation of RIMIS when access will be limited to personnel at key centers only |
| | • Enter information via mobile/wireless devices when future phases of RIMIS include remote capability. |
Table 5-3
User Class Interactions with RIMIS, continued

<table>
<thead>
<tr>
<th>Public Affairs/Community Relations Offices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Primarily responsible for providing program management and interface with the media/general public for dissemination of information/press releases</td>
<td>• Input directly into RIMIS information about event schedules, agency notifications, special announcements, and other pertinent information</td>
</tr>
<tr>
<td>• Coordinate events and work with other agencies as part of multi-agency efforts</td>
<td>• Monitor RIMIS for pertinent information and notifications from other agencies.</td>
</tr>
<tr>
<td>• Respond to requests to media concerns regarding incidents, road closures, or public safety concerns.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information Service Providers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Serve as additional sources of information for RIMIS and include both public and private entities, such as:</td>
<td>• Transmit data to RIMIS via an automated interface or manually to the database</td>
</tr>
<tr>
<td>– TMAs</td>
<td>• Receive RIMIS information (e.g., traffic speeds, construction and maintenance activity, and video) and relay it to the public in each information service provider’s preferred format.</td>
</tr>
<tr>
<td>– Media</td>
<td></td>
</tr>
<tr>
<td>– Traffic reporting services</td>
<td></td>
</tr>
<tr>
<td>– Airports</td>
<td></td>
</tr>
<tr>
<td>– Event venues</td>
<td></td>
</tr>
<tr>
<td>– Convention/Visitors Bureau</td>
<td></td>
</tr>
<tr>
<td>– Other related state, regional or local agencies.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Management and Administration Staff</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Include representatives from non-operational entities that play a critical role in overall program management, guidance, contract management, funding, and other key administrative components of the program</td>
<td>• Provide the overall guidance, contract management, system enhancement, planning, and funding functions related to RIMIS but do not play a direct operational role, contribute information to RIMIS, or rely on real-time RIMIS information to carry out their day-to-day responsibilities</td>
</tr>
<tr>
<td>• Includes FHWA, FTA, and DVRPC.</td>
<td>• Use archived data related to traffic speeds, volumes, and incidents to monitor traffic trends and generate capital projects for providing remedies to chronic problems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outside Vendors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Include manufacturers that supply ITS devices; designers that help to develop system enhancements, expansions, or interfaces for efficient data exchange; and contractors that supplement agency staff to assist existing staff perform the day-to-day activities.</td>
<td>• Under contract with a RIMIS partner agency, assist in system upgrades and repairs of field devices, communications networks, and computer systems and sometimes serve as system manager/operator</td>
</tr>
<tr>
<td></td>
<td>• Responsible for operating, maintaining, and upgrading RIMIS software.</td>
</tr>
</tbody>
</table>

5.5.3 Interactions Among User Classes

The user classes described in the Section 5.5.3 interact with RIMIS to varying degrees. These classes range from direct users and sources of data to the support staff that maintain the communication networks and interfaces. Dependable information sharing, critical to a successful partnership of agencies and departments, requires a proactive approach for monitoring data and responding to incidents and events. Data flows between agency systems and RIMISnet nodes depend on individual user classes interacting to create the RIMIS network of information.

In addition to user class interactions with RIMIS, the user classes interact and depend on other user classes for data through RIMIS. These interactions provide supplemental data to a user class that in turn enhances their daily operations and ability to respond to incidents appropriately.

At the top level for a control center/dispatch center, information from RIMIS is directly viewed and accessed by the controllers/dispatchers. The control center/dispatch center could be the central data center for a state department of transportation, transit agency, toll authority, city street/public works department, or emergency response agency. The operators/dispatchers receive direct information by monitoring their respective systems and from field personnel responding in emergency response units.
This information may be supplemented by additional data from RIMIS, such as construction and maintenance reports, traffic control status, traffic flow data, planned events, transit information, and weather conditions from the various RIMIS partner agencies. The operator/dispatcher monitors and interprets the data to determine the appropriate course of action to respond to the incident or special event identified through analysis of data. **Figure 5-9** provides the data flow expected in control center/dispatch center.

If the incident or special event necessitates additional analysis to determine the appropriate course of action, the data will be sent to supervisors or other managers within the control center/dispatch center for review. As a result, the controllers/dispatchers will initiate the emergency response requests, public safety reports, and/or emergency alerts based on information they have received from their internal systems and field personnel. In some instances, they will also dispatch maintenance crews as a matter of policy or on the request of law enforcement/public safety or other agency. This information also will be made available to other user classes for monitoring and response. **Figure 5-10** provides the data flow within a control center/dispatch center during an incident or scenario that may require attention from other user classes. Depending on the level of incident, emergency management authorities and Public Affairs offices may also be involved.
On a second tier, user classes make an impact on RIMIS, but not as direct users or sources of data. Instead, these user classes provide support services that allow data to be made available for input into RIMIS for use by other user classes. These support user classes include information technology staff, which may vary from agency to agency.

Another critical aspect to RIMIS is the actual data flow from the field devices through RIMIS and to each user class. The data flow is dependent on the communication network that links the field devices to a control center, from a control center to RIMIS, and then to each participating user class. This CONOPS assumes no data-producing or data-using field devices will directly feed or access RIMIS and all field data must go through an operations center. Whether the communication network is wireless or hard-wired, the communication network must be dependable and redundant during times of potential failures. In order to monitor, maintain, and repair the communication network, each agency should have communication maintenance forepersons and maintainers. As stated earlier, communications maintenance personnel are not direct users of RIMIS nor are these sources of RIMIS data. Their supporting role however, is as important as that of a user or other data source since they help ensure that RIMIS is capable of executing the information exchange.
5.5.4 Other Involved Personnel

Policy makers, governmental officials, and Federal Government representatives, such as those from the FHWA, make up another class of RIMIS users. These do not have direct interaction with the RIMIS as an end user, but they are able to influence the evolution of RIMIS since they representing the public interest as it pertains to improved living conditions through enhanced travel. They may work with operations and maintenance management personnel, security management, and public affairs management to identify system enhancements which represent these interests at the highest levels of policy.

This class of user may also have authority to influence, approve or deny funding of RIMIS system enhancements. They may also be involved in project oversight to ensure the specified design criteria are met. Their top-level involvement is therefore important since they are key to the continued development of the RIMIS.

Although not an operational entity, the DVRPC plays a key role in providing the regional forum in which RIMIS partner agencies (via the RIMIS subcommittee and ITS Technical Task Force) can move through planning, design, implementation, operations, and ongoing system enhancements. In the initial stages of RIMIS, the DVRPC will continue its role as the regional forum to bring together partners, and facilitate ongoing coordination to develop and enhance RIMIS. The DVRPC will serve in a key funding role to apply for federal funds on behalf of the region to fund RIMIS implementation and operations. In a program manager/administrator role, the DVRPC, through the ITS Coordinating Council, will serve as the forum for key policy decisions related to RIMIS operations, operations and integration. Responsibility for contract management during the initial implementation and subsequent development phases will also fall to the DVRPC. This will provide a needed level of management continuity as the system moves from implementation through operations and enhancements and as the number of RIMIS partners increases. Once RIMIS is underway, the partners are responsible for deciding how the organizational structure to evolve as the system evolves.
5.6 SUPPORT ENVIRONMENT

Once the first version of RIMIS is fully tested and operational, the project begins a phase that includes concurrent development of the next release and a routine Operations and Maintenance (O&M) cycle. O&M include hardware and software costs and the professional services expenditures needed to properly maintain any software application. In the case of RIMIS, these support requirements are key to providing users with a 24x7 system availability and exceptional technical support. Uptime is critical to realizing the system’s potential as a collaborative information sharing tool among members. Included in these recurring software maintenance costs are annual maintenance contracts, upgrade cycle costs and costs related to “bug fixes” and application troubleshooting. Hardware costs include maintenance contracts and hardware upgrades to ensure the RIMISnet infrastructure has sufficient capacity to minimize network latency as the user base expands and network message traffic increases.

RIMIS is unusual in this context because no single agency can claim ownership of the project and, by extension, any of the noted recurring costs. This characteristic increases the chances that RIMIS members will not properly fund O&M costs, thereby reducing the reliability of RIMIS and its potential success. It is important that RIMIS member organizations understand that the success of RIMIS, on both technical terms and as a collaborative endeavor, will lay the groundwork for the FHWA’s ITS architecture. If viewed from this perspective, RIMIS is an important proof of concept for the eventual rollout of the entire ITS infrastructure in the Delaware Valley.
6.0 OPERATIONAL SCENARIOS

Operational scenarios provide a means of testing the RIMIS concept in the context of operational situations. They allow designers and implementers to derive operational assumptions of how the system needs to function and provides the basis for more detailed requirements to be developed following consensus on the operational concept. Ad-hoc interactions among participants demonstrated how RIMIS functionality could supplement current and established operational actions and objectives.

Section 5.4 of this CONOPS outlined three key modes of operations in which RIMIS functionality will be of most benefit to users in the Delaware Valley Region:

- Normal (day-to-day) operating conditions
- Planned events and closures
- Incident conditions.

Section 5 also outlined key data sources and RIMIS interfaces to support information sharing and messaging during the three key operational modes and how different types of users are envisioned to interact with RIMIS.

Different types of events will prompt corresponding levels of usage of RIMIS by different types of agencies in the region, although a core level of RIMIS functionality will be available irrespective of the event situation. This section provides more detailed information about the core system functionality and how it will support various operational modes and conditions.
6.1 Testing the Operational Concept

As part of the CONOPS development, an Operational Scenario Workshop was held with RIMIS partner agencies to discuss how RIMIS could be used under different event scenarios. One scenario focused on an unplanned incident (e.g., an accident on the Walt Whitman Bridge) and how agencies could use RIMIS as part of their information exchange and response procedures. The other scenario focused on how RIMIS could support agencies as part of information exchanges and updates during a planned special event or multiple events (e.g., at the Philadelphia Sports Complex).

The outcome of the workshop showed that RIMIS will deliver the most benefit as an information sharing medium and decision-making tool for participating agencies to use during an unplanned incident. For pre-planned special events, it will benefit those agencies feeding traffic into and out of the general area of the event while for agencies managing the event, the RIMIS benefits are more limited. Although these are high-level depictions of several types of potential incidents that could affect the transportation network in the Delaware Valley, broad conclusions can be drawn from them.

For planned events, agencies have a well-established coordination strategy among traffic managers (state and local, bridge operations), police and public safety, event venue/promoters, and others. This coordination begins prior to event day, and established traffic management and parking strategies are put in motion depending on the type and timing of the event. In discussing some “what if” circumstances as part of a planned event, some participants did not identify a strong role for RIMIS as part of their overall event management strategies or missions. However, many other participants said they were not in the loop because agencies responsible for event coordination only focus on the event’s immediate vicinity and not on the roads leading to and from it. These participants suggested that RIMIS could be a mechanism to incorporate them into the coordination process by informing them of event activities and enabling them to send information about their operations to event planners.

The unplanned event, consisting of an incident, major road closure, and traffic diversion, showcased the best opportunity for agencies to use and benefit from the information exchanges provided by RIMIS. The unplanned event demonstrated where RIMIS could supplement and, in some cases, enhance current procedures and responses that agencies use in managing incident-generated traffic and congestion. In these instances, they could use RIMIS for broadcasting messages, thus minimizing the need for manually faxing or contacting individual agencies to notify of an incident or provide status updates. Participants also saw RIMIS as a valuable tool for informing other agencies that might otherwise not be in the contact loop for a particular event, closure, diversion, and any actions that have been taken. Because RIMIS does not disrupt or impede established agency response and management processes, the participants viewed its capability for coordinated and automated information dissemination and notifications as a benefit.
6.2 **SYSTEM OPERATING SCENARIOS**

The Operational Scenario Workshop held with RIMIS partners yielded valuable input related to the desired functionality, and how RIMIS could or could not be used under various operating conditions. As mentioned earlier, RIMIS functionality will focus on the following core functions and capabilities that will enable partners to:

- View current status of the transportation network, including location and nature of planned closures and restrictions, incidents, and weather hazards
- Access calendars to view upcoming planned closures or restrictions
- Access messaging capability to:
  - Receive important messages about transportation conditions or wide area alerts
  - Notify RIMIS partners about a reported incident
  - Transmit current, important details to numerous other agencies about a significant impact on the region’s transportation network
  - Request specific agency responses or actions
  - Request status of devices, closures, and detours
  - Request responses to requests
  - Notify that an incident has been cleared
  - Broadcast information to all partner organizations, a select group, or an individual agency.

Different types of events will prompt corresponding levels of usage of RIMIS by different types of agencies in the region, although a core level of RIMIS functionality will be available irrespective of the event situation. The view status, query, message and receive message capability within RIMIS will be available 24x7. Although activity will increase on the RIMIS network during major incidents, unique or special features that are implemented during major incidents or other special conditions will not disrupt the RIMIS core functionality.

6.2.1 Sample Graphical User Interface Scenarios

Earlier sections of the CONOPS have outlined how RIMIS will function and how various types of users will generally interact with the system. This sub-section looks at how the users will be able to access RIMIS functions and features through sample GUI screen shots. One of the guiding principles of RIMIS development is to allow participating agencies a level of flexibility and customization in designing their particular GUIs. The purpose of these sample screen shots is to convey basic RIMIS functions and those features that are expected to be used by various partners. Specific details of the GUI, including appearance, transitions, buttons, and GIS map preferences, will need to be developed during the design phase.

Figure 6-1 shows an initial RIMIS screen sample that provides users with the following features:

- Instant view of the region’s transportation system via the GIS map
- Current date, time, and weather conditions
- Daily view of major events (planned or unplanned) impacting the region’s transportation system
- Access to secure log-in screen.
Figure 6-1
Sample RIMIS GUI (Initial Screen)
By logging in with a username and password, the user will be able to access more detailed information about scheduled events by clicking a calendar feature, for example; to view messages and initiate them; and to see if a message is waiting to be viewed. The screen sample shown in *Figure 6-2* also allows the user to “hover” over the map to get more detailed information about a particular incident, closure, or device.

*Figure 6-2*
Sample RIMIS GUI (Logged In Screen)
By clicking “New Message,” the user will be taken to another browser window as shown in **Figure 6-3**. The procedures to create a message will be structured in a manner to yield consistent and unambiguous messages that can be understood by all RIMIS users. Using the TMDD, MS/ETMCC, and IEEE 1512 standards as guides, a series of input screens will be developed in the design phase that will facilitate data entry in a uniform manner. A special screen with pull-down menus will offer the user a choice of types of activity, such as pre-planned construction activity, and associated information, including location, lanes blocked, start interval, end interval, and status. Data definitions will be consistent with the TMDD, and the data items will be consistent with message set guidelines. In this manner manually inputted data can be converted easily into message sets.

![Figure 6-3 Sample RIMIS Message Initiate Screen](image)

**Figure 6-3**
Sample RIMIS Message Initiate Screen
By clicking “View Message Log” from the main screen, the user will be able to see a sequential log of messages that have been sent, including messages directed to them and broadcast messages. Figure 6-4 shows sample messages generated during the Operational Scenarios Workshop. Workshop participants have requested that they be allowed to filter out some messages, such as from selected agencies and entities. In accommodating this request, parameters should be built into the design to ensure that certain messages never be filtered, such as high-priority messages, broadcasts, and messages from certain entities such as state emergency management authorities.

Figure 6-4
Sample RIMIS Message Log
6.2.2 Sample Incident Message Sequence

Through the Operational Scenario Workshop, participants provided the system manager team with the types, nature, and sequence of potential messages that agencies foresee sharing, including information they would need and request messages for actions specific to a major incident, such as one of the region’s bridges. In “walking through” a type of incident that was likely to occur on the region’s transportation network, agencies provided critical pieces of information related to:

- Timing of requests
- Origin/Destination of requests
- Types of information agencies needed from other agencies
- Types of information that would be appropriate to broadcast to all RIMIS agencies (broadcast notifications)
- Stimuli or “triggers” that would prompt requests for additional information (based on agency function)
- Requests for specific actions or status updates.

Because the purpose of the operational scenarios was to gain insight into the information flow and decision-making processes, agencies were encouraged to use unstructured messages.

**Incident on the Ben Franklin Bridge**

The first operational scenario tested was a HAZMAT incident on the Walt Whitman Bridge because the nature and location of the scenario incident involved a wide range of RIMIS partners. This exercise provided an exceptional insight into the depth and breadth of the RIMIS messaging capability and the degree to which partners would potentially rely on this valuable function.

The incident involved a tanker truck collision on the Walt Whitman Bridge in the westbound direction at 5:45 a.m., at the beginning of the morning rush hour. As the incident unfolded, participants were informed that all lanes were blocked, and it potentially involved a HAZMAT situation and structural damage to the bridge. By 2:00 p.m., the incident was cleared and the bridge reopened to traffic.

Participants in the workshop included representatives from the following agencies:

- Camden County 911 Communications Center
- DRPA Police
- New Jersey Transit
- NJTA
- New Jersey State Police
- NJDOT Traffic Operations South
- PEMA
- PennDOT District 6-0 Traffic Control Center
- Pennsylvania State Police
- Philadelphia Fire Department
- Philadelphia Streets Department
- Philadelphia Traffic Police
- SEPTA
- SJTA.

**Table 6-1** shows the step-by-step sequence of messages and information exchanges, requests, origin agencies, and destination agencies that resulted from this workshop.

The message log begins when the 911 Communications Center issues a notification about an accident that has been called in. It is important to note the specific details that agencies are requesting, such as contents of the tanker truck, road closure time/duration, information on whether or not both sides would be closed, and what messages are placed on VMS signs.
During the exercise, the need for RIMIS is highlighted in several different ways. First, when the Philadelphia Fire Department dispatcher is notified about the incident, it automatically notifies the Philadelphia Police Department. Because the information is geo-coded to an address, and the bridge is not named in the notification, the traffic police do not know about the overturned truck until they observe traffic backed up on the Walt Whitman Bridge approaches. Second, the agencies perform most of the messaging manually. It becomes obvious that one-to-many broadcast capability is a more effective approach to notifying other agencies. Third, as the accident evolves, and more information becomes available on how serious the accident is, various agencies constantly update the information.

While the operational scenario primarily focused on messaging, it did offer insight on what other features on RIMIS could be of use to agencies as they responded to the incident. Video images of both the accident scene and of traffic conditions were a high priority. Camden County 911 Communications said they would have viewed CCTV images to gauge how bad the accident was and to assess the best way to reach the scene. Philadelphia Traffic Police wanted video to monitor congestion levels. Nearly an hour after the accident, the Pennsylvania State Police asked PennDOT to describe the situation on the bridge using their cameras. While it was never explicitly mentioned, it was apparent that traffic-flow information would have been of assistance to the agencies in identifying the limits of congestion surrounding the Walt Whitman Bridge and monitoring the parallel bridges. For example, about 45 minutes after the accident, the Philadelphia Streets Department asked the DRPA Police stationed at the Ben Franklin Bridge about traffic volumes.

Multiple Events at the Philadelphia Sports Complex

This scenario examined multiple events at the Philadelphia Sports Complex. The basic premise for the scenario was the Philadelphia Eagles is notified that it will host a National Football League (NFL) playoff game the following Sunday afternoon. A Philadelphia 76’ers basketball game is scheduled for Sunday evening at about the same time as the playoff game is expected to end. As workshop participants plan for the events, the threat of a massive snow storm for Sunday is introduced into the scenario.

Participant in the workshop included the following agencies:

- DRPA Police
- NJDOT – Traffic Operations South
- PennDOT District 6-0 Traffic Control Center
- Philadelphia Streets Department
- Philadelphia Traffic Police
- SEPTA
- Sports Complex Special Services District
- Philadelphia Eagles
- Philadelphia 76’ers
- Comcast Spectator.

Because a similar event actually occurred recently when a snow storm struck Philadelphia a few days before an Eagles playoff game, workshop participants found it difficult to focus on the scenario rather than rehash actual events.

In planning for the Sunday game, participants used the currently established procedures for planning events at the Sport Complex. Philadelphia Traffic Police, the Sports Complex Special Services District, the affected venue owners, and the Philadelphia Streets Department reviewed their standard procedures, which are scalable to the size of the event, and adjusted them for the game. Most participants appeared satisfied with the planning phase for the special event.

During the event, however, communication problems related to the sports venue emerged that revealed the need for improved coordination. Traffic police and Sports Complex staffs operate out a joint operations center informally established at the complex. They primarily focused on the streets, ramps, and parking lots immediately adjacent to the sporting venue rather than the conditions on highways leading to the Sports Complex. From their perspective, the need to exchange information with other
agencies was minimal. However, agencies managing these “external” facilities expressed frustration at their inability to communicate with the Sports Complex. They wanted to be able to deliver traffic and parking information before the game via VMS signs to approaching fans. The participants had two concerns for post-game conditions: First, they wanted to be notified when the game ends, which will allow them to monitor traffic conditions more closely and initiate other appropriate actions. Second, they would like the Sports Complex to notify the fans if an event has affected road conditions (e.g., an accident near the venue) before the games end, allowing fans to avoid the impacted roadways. RIMIS can provide the functionality to meet these communication needs.
## Table 6-1

### Step by Step Sequence

<table>
<thead>
<tr>
<th>Log #</th>
<th>Time</th>
<th>Message From:</th>
<th>Message To:</th>
<th>Message Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/31/05 5:45</td>
<td>Camden County 911 Communications Center</td>
<td>Gloucester City Fire, DRPA PD, NJSP</td>
<td>MVA w/ injuries, tanker truck vs vehicle, numerous calls, west bound, location unknown</td>
</tr>
<tr>
<td>3</td>
<td>1/31/05 5:50</td>
<td>DRPA Police</td>
<td>NJDOT - Traffic Operations South, NJSP, Gloucester City Fire Department, Philadelphia Fire</td>
<td>Call NJDOT, NJSP, Gloucester Fire, Phila. Fire</td>
</tr>
<tr>
<td>4</td>
<td>1/31/05 5:52</td>
<td>Camden County 911 Communications Center</td>
<td>DRPA Police</td>
<td>Reported MWA on WWB. Tanker vehicle, injuries confirm?</td>
</tr>
<tr>
<td>5</td>
<td>1/31/05 5:54</td>
<td>NJDOT Traffic Ops</td>
<td>DRPA Police</td>
<td>ESP on route and VMS in use, 42 &amp; 295 N/S</td>
</tr>
<tr>
<td>5</td>
<td>1/31/05 5:55</td>
<td>NJDOT Traffic Ops</td>
<td>DRPA Police</td>
<td>How long? How's Betsy and Ben?</td>
</tr>
<tr>
<td>8</td>
<td>1/31/05 6:00</td>
<td>Philadelphia Fire Department</td>
<td>PEPA</td>
<td>Tanker truck overturned WWB, Hazmat unit dispatched.</td>
</tr>
<tr>
<td>9</td>
<td>1/31/05 6:01</td>
<td>DRPA Police</td>
<td>Broadcast</td>
<td>Which direction is MVA? Where on bridge? What is the best way to get to the incident?</td>
</tr>
<tr>
<td>10</td>
<td>1/31/05 6:02</td>
<td>Philadelphia Fire Department</td>
<td>DRPA Police</td>
<td>Reported Jackknife TT on WWB. Confirm? Accident westbound. Any effect on eastbound lanes which would impact PA traffic crossing the river? Will PennDOT ITS assets be useful? (PennDOT would first try to verify the incident with CCTV assets on I-66)</td>
</tr>
<tr>
<td>11</td>
<td>1/31/05 6:04</td>
<td>PennDOT District 6 Traffic Control Center</td>
<td>DRPA Police, NJDOT, Broadcast Traffic Services, TRANSCOM</td>
<td>Reported jackknife TT on WWB. Confirm? Accident westbound. Any effect on eastbound lanes which would impact PA traffic crossing the river? Will PennDOT ITS assets be useful? (PennDOT would first try to verify the incident with CCTV assets on I-66)</td>
</tr>
<tr>
<td>12</td>
<td>1/31/05 6:05</td>
<td>PEMA</td>
<td>Philadelphia Fire Department</td>
<td>Tanker contents? Entered river? Road closure time? Detour in place? Victims?</td>
</tr>
<tr>
<td>13</td>
<td>1/31/05 6:06</td>
<td>SJTA</td>
<td>NJDOT Ops South</td>
<td>Do you need activation of signs to inform communities of delay/detour?</td>
</tr>
<tr>
<td>14</td>
<td>1/31/05 6:06</td>
<td>SJTA</td>
<td>DRPA Police</td>
<td>What’s in the truck? Has anything spilled? If so, how much? Did it get into river?</td>
</tr>
<tr>
<td>15</td>
<td>1/31/05 6:12</td>
<td>NJDOT Traffic Ops</td>
<td>DRPA</td>
<td>Is this Hazmat? What? ED? Est. duration?</td>
</tr>
<tr>
<td>16</td>
<td>1/31/05 6:15</td>
<td>PEMA</td>
<td>PEMA E/A, PA DEP, PSP, PennDOT, PA Turnpike, U.S. Coast Guard, DRPA, EPA, Fish &amp; Boat, TRANSCOM, OHS, PUC - Motor Carri, Dept. of Health</td>
<td>Notify all listed agencies of crash and known info. Mandatory phone communications w/ addressees per PEMA policy.</td>
</tr>
<tr>
<td>17</td>
<td>1/31/05 6:20</td>
<td>NJDOT Traffic Ops</td>
<td>NJSP Incident Management Team</td>
<td>OT Truck, Fuel Oil, Hazmat, Estimated duration 2+ hrs.</td>
</tr>
<tr>
<td>18</td>
<td>1/31/05 6:23</td>
<td>PEMA</td>
<td>Philadelphia Fire Department</td>
<td>Incident commander reports possible structural damage to bridge.</td>
</tr>
<tr>
<td>19</td>
<td>1/31/05 6:33</td>
<td>Phila. Streets</td>
<td>DRPA BF Bridge</td>
<td>Volume on the BF Bridge?</td>
</tr>
<tr>
<td>20</td>
<td>1/31/05 6:38</td>
<td>PennDOT District 6 Traffic Control Center</td>
<td>NJDOT Traffic Ops South</td>
<td>Any plan for complete closure on bridge in both directions?</td>
</tr>
<tr>
<td>21</td>
<td>1/31/05 6:40</td>
<td>PSP ODC</td>
<td>PennDOT District 6 Traffic Control Center</td>
<td>Describe situation on bridge from cameras</td>
</tr>
<tr>
<td>22</td>
<td>1/31/05 6:43</td>
<td>Philadelphia Fire Department</td>
<td>Coast Guard, PEMA</td>
<td>Fuel oil spill on WWB. Unknown if entered river, or amount spilled...</td>
</tr>
<tr>
<td>23</td>
<td>1/31/05 6:45</td>
<td>NJDOT Traffic Ops. South</td>
<td>Penn DOT</td>
<td>Our side closed. No plan for your side.</td>
</tr>
<tr>
<td>24</td>
<td>1/31/05 6:47</td>
<td>PennDOT District 6 Traffic Control Center</td>
<td>Pennsylvania State Police</td>
<td>Jackknifed TT in westbound lanes of WWB. Possibly overturned. Also a HAZMAT with fuel oil spill. CCTV indicating traffic delays building on eastbound side. Assuming eastbound gaper delay, but still awaiting more info. Westbound lanes of bridge closed.</td>
</tr>
<tr>
<td>25</td>
<td>1/31/05 6:50</td>
<td>PennDOT District 6 Traffic Control Center</td>
<td>NJDOT, DRPA</td>
<td>Advise NJ-bound drivers via VMS activation on I-95 and I-76 of accident on WWB, and suggest use of BF or BR Bridges into NJ.</td>
</tr>
<tr>
<td>26</td>
<td>1/31/05 7:00</td>
<td>DRPA Police</td>
<td>Broadcast</td>
<td>Internal: Engineers called in). Bridge closed in both directions.</td>
</tr>
<tr>
<td>27</td>
<td>1/31/05 7:05</td>
<td>PennDOT District 6 Traffic Control Center</td>
<td>NJDOT, DRPA</td>
<td>Advise NJ-bound drivers via VMS activation on I-95 and I-76 of WWB closure, avoid all roads and ramps leading to bridge.</td>
</tr>
<tr>
<td>28</td>
<td>1/31/05 7:10</td>
<td>DRPA Police</td>
<td>I-95 Corridor</td>
<td>Use IEN message: WWB closed. Duration unknown.</td>
</tr>
<tr>
<td>29</td>
<td>1/31/05 7:15</td>
<td>DRPA Police</td>
<td>Philadelphia Police</td>
<td>Requesting assistance. Updated notification.</td>
</tr>
<tr>
<td>30</td>
<td>1/31/05 8:00</td>
<td>DRPA Police</td>
<td>PENCOM</td>
<td>Changes/updates</td>
</tr>
<tr>
<td>31</td>
<td>1/31/05 8:00</td>
<td>NJDOT Traffic Ops</td>
<td>NJTPK, ACE, DRPBA, DELDOT, CHART, NJDOT TOC-N, News Agencies</td>
<td>WWB closed until further notice</td>
</tr>
<tr>
<td>32</td>
<td>1/31/05 8:15</td>
<td>PEMA</td>
<td>Coast Guard</td>
<td>Notice of bridge closure</td>
</tr>
<tr>
<td>33</td>
<td>1/31/05 16:30</td>
<td>DRPA Police</td>
<td>Broadcast</td>
<td>Notice of bridge accident scene cleared</td>
</tr>
<tr>
<td>34</td>
<td>1/31/05 16:31</td>
<td>City Streets, NJDOT, PennDOT</td>
<td>Broadcast</td>
<td>Advice of changed VMS reflecting afternoon rush</td>
</tr>
<tr>
<td>35</td>
<td>2/1/2005 0:00</td>
<td>NJDOT TOC 5, PennDOT District 6 TCC</td>
<td>Broadcast</td>
<td>Advice of changed VMS reflecting bridge opening</td>
</tr>
</tbody>
</table>
7.0 SUMMARY OF IMPACTS

This section describes the impacts of the proposed RIMIS system. RIMIS is intended to provide a valuable tool to support agency information-sharing and coordination and to enhance individual agency missions and operations. Although RIMIS partners can expect their current operations to be facilitated by use of the system, they should be prepared to accept certain operational and organizational impacts. To a certain extent, partner agencies in the Delaware Valley will need to modify existing systems, processes, procedures, and other operational aspects to enable RIMIS functionality and accommodate the responsibilities entailed in RIMIS implementation.

Some impacts from RIMIS will affect various types of users at partner agencies and will require adding new kinds of duties and actions to current staff responsibilities. Other impacts will need to be addressed more at the organization level and on an agency-by-agency basis. For example, many RIMIS partner agencies will need to evaluate how RIMIS can integrate with their overall mission and objectives and develop additional policies and procedures, budgeting requirements, and other organizational courses of action to accommodate RIMIS. RIMIS presents opportunities to improve traffic and incident management in ways that agencies cannot currently envision. In addition to providing more detailed information about an incident, RIMIS will also display the big picture about situational conditions. To fully take advantage of these opportunities, agencies will need to be flexible about changing their procedures and operating policies.

With the proposed phased implementation, RIMIS will not make these impacts on all agencies at the same time, nor to the same degree. For example, the implementation effort and beneficial impact for agencies merely using the new system as a notification or query tool will be less than to those agencies planning to use system's full functionality. In the latter case, they may need automated interface(s) between RIMIS and one or more of their legacy systems, which will require time to develop, test, and implement the software changes as well roll out any associated hardware.

The following three subsections discuss operational impacts, organizational impacts, and impacts during development. Each partner agency will need to assess the appropriate level of organizational support and change required to accommodate RIMIS as part of its daily operations and achieve its "big picture" organizational objectives.
7.1 OPERATIONAL IMPACTS

Table 7-1 provides a summary of anticipated operational impacts to the various RIMIS user classes. Operators/Dispatchers and public safety operators/dispatchers user classes will experience the greatest impact on day-to-day functions since these will have the most direct interaction with RIMIS on a daily basis. These user classes will need to incorporate RIMIS tasks and duties in their existing responsibilities. They will be responsible for entering information into RIMIS, monitoring it for notifications, responding to requests and acting on information received from RIMIS, and initiating communications with internal and external entities based on information that is made available through the new system.

RIMIS will produce some level of operational impact on the majority of RIMIS partners. Traffic operations and management, transit, emergency management/law enforcement, and other key sources of incident and real-time or planned information about the region’s roadways will be the significant data sources and information service providers. These entities will need to make procedural and system modifications to accommodate RIMIS functions and requirements. Many of these organizations have procedure manuals for their operators and rigorous training courses that will need to be modified to accommodate the use of RIMIS.

RIMIS users also will be responsible for acting on information received through RIMIS. Information and knowledge about transportation network conditions, particularly significant incidents or impacts, will require RIMIS partners to respond with resources and actions, and possibly make changes to strategies already in progress. Armed with better, more reliable and more comprehensive information about the region, agencies will be better able to make the necessary adjustments to operational strategies.

Agencies have identified information overload from messages broadcast over RIMIS as a significant potential operational impact on their operations. Filters at the message receiver’s end can address this problem by filtering out certain types of non-emergency messages. Another major operational concern is the double-entry; agencies can address this issue using an automated interface. For agencies that do not have a TMDD-compliant database, RIMIS will extract the relevant data, translate them, and function as the agency’s interim database until a compliant database is developed. The double-entry issue may not be readily resolved at some agencies.

<table>
<thead>
<tr>
<th>User Classes</th>
<th>Operational Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations and Maintenance</td>
<td>• Improve decisionmaking by having access to more comprehensive, real-time regional</td>
</tr>
<tr>
<td>Management Personnel</td>
<td>information</td>
</tr>
<tr>
<td></td>
<td>• Implement and champion policies and procedures for RIMIS usage within agency,</td>
</tr>
<tr>
<td></td>
<td>including operational, technical and administrative requirements</td>
</tr>
<tr>
<td></td>
<td>• Revise procedure manuals to incorporate how RIMIS information is to be used</td>
</tr>
<tr>
<td></td>
<td>within context of agency objectives and mission</td>
</tr>
<tr>
<td></td>
<td>• Incorporate RIMIS into control center training programs</td>
</tr>
<tr>
<td>Control Center/Dispatch</td>
<td>• Implement training program for operations staff on how to use RIMIS and RIMIS</td>
</tr>
<tr>
<td>Center Managers</td>
<td>functions</td>
</tr>
<tr>
<td></td>
<td>• Develop, implement, and document policies and procedures for RIMIS usage within</td>
</tr>
<tr>
<td></td>
<td>agency, including operational, technical, and administrative requirements</td>
</tr>
<tr>
<td></td>
<td>(e.g., modifies existing procedure manuals, training programs)</td>
</tr>
<tr>
<td></td>
<td>• Require supervision and training of operations staff who will be directly</td>
</tr>
<tr>
<td></td>
<td>interfacing with RIMIS</td>
</tr>
<tr>
<td></td>
<td>• Respond to RIMIS-generated requests, including making resource commitments</td>
</tr>
<tr>
<td></td>
<td>on behalf of agency in response to a request or specific incident/event</td>
</tr>
<tr>
<td></td>
<td>• Coordinate IT/interface needs between RIMIS and agency systems</td>
</tr>
<tr>
<td>User Classes</td>
<td>Operational Impacts</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Operators/Dispatchers                | From an operations perspective, make the most visible impact on day-to-day activities of operators/dispatchers and front-line operational staff that will need to use, monitor, input, extract and interpret information from RIMIS on a daily basis. Expand duties to RIMIS monitoring and operations and make related impacts, including:  
  • Monitor RIMIS information and alerts (in accordance with established agency policy)  
  • Initiate and respond to messages and requests in accordance with established agency policy  
  • Interpret RIMIS data for potential agency actions and notifies appropriate staff (management) of adverse conditions or requests  
  • Coordinate with appropriate staff (e.g., maintenance, responders) to respond                                                                                                                                                                                                                                                                                        |
| Information Technology Staff         | • Require additional IT support to implement and maintain local interfaces between agency systems and RIMISnet or coordinates with vendor to implement and maintain local RIMIS interface  
  • From an operational perspective, review how RIMIS fits in with their respective agency’s technology policies and procedures.                                                                                                                                                                                                                                                                                                |
| Emergency Management Authorities     | • Provide state and regional emergency management authorities with a comprehensive distribution channel to notify several agencies simultaneously of an incident or wide-scale emergency conditions.  
  • From an operational standpoint, help to streamline current manual process of contacting individual agencies by phone, fax, other means.  
  • Require review and revision of current EMA policies that require a verbal confirmation of contact.                                                                                                                                                                                                                                                                                                    |
| Public Safety Operators/Dispatchers  | Critical to operations, act as initiators of incident notifications and messages on incidents and their locations using established protocols for notifying the appropriate agencies of an incident and initiating a CAD log. RIMIS must work within these established communications processes, without disrupting or superseding these critical processes:  
  • Entail managers of public safety operators/dispatchers to coordinate with appropriate authorities to develop processes to integrate RIMIS messaging and notification tasks and duties with their established processes.  
  • As an alternative to minimize operator involvement, establish interfaces between RIMIS and PSAP CAD systems (historically a difficult institutional barrier to address)  
  • Use RIMIS information to provide route guidance to emergency responders.                                                                                                                                                                                                                                                                                        |
| Emergency Response/Law Enforcement Personnel | • Improve quality of information that is used to make decisions  
  • Enable in-the-field personnel to directly view and enter information (if wireless devices are implemented)  
  • Require that operational policies and procedures be developed and implemented to accommodate enhancements such as wireless devices                                                                                                                                                                                                                                                                                                                                 |
| Public Affairs/Community Relations Offices | Make minimal impact but add responsibility for updating agency/entity calendar and event information, periodically monitoring RIMIS messages and information, and incorporating RIMIS data entry into daily/weekly operational duties.                                                                                                                                                                                                                                                                                                        |
| Information Service Providers        | • Expect minimal operational impact (may vary depending on the ISP)  
  • Use as search and query tool by traffic reporting services  
  • Receive notifications of major incidents similar to current operations at traffic or emergency management agencies  
  • Serve as data provider, which requires development and maintenance of interfaces, and access to enter data manually                                                                                                                                                                                                                                                                                                           |
| Program Management and Administration Staff | • Expect minimal day-to-day operational impact, because staff are not operational entities (see Section 7.2, Organizational Impacts, which addresses primary impacts)  
  • Anticipate influential role in overall operations of RIMIS as regional entities that support implementation, coordination, and training (e.g., developing RIMIS training and capacity building programs and facilitating consistent training among partner agencies); facilitate policy and procedures development; and provide and overall program administration, at least for the initial RIMIS phases                                                                                                                                                                                                 |
| Outside Vendors                      | Expect varying operational impacts, depending on the vendor and its role, as well as its relationship to the various RIMIS partner agencies                                                                                                                                                                                                                                                                                                                                                      |
7.2 ORGANIZATIONAL IMPACTS

From an organizational perspective, RIMIS will require a regional approach to implementing, utilizing, training, enhancing and expanding RIMIS functions. In the short term, there will need to be consensus on key requirements and functions, operational parameters and roles and responsibilities while in the longer term, there will need to be continued collaboration in terms of additional phases of RIMIS, new functions and features, and a commitment to maintaining and utilizing RIMIS. This requires an investment on the part of agencies to integrate RIMIS into their organizational functions by training staff, developing and implementing policies and procedures, as well as potential technical and system modifications to accommodate RIMIS within their systems and operations.

7.2.1 Impacts to Partner Agency Staffing/Human Resources

Section 7.1 described how RIMIS is expected to impact various users. From a broader agency perspective, RIMIS will require adjustments be made to current staff duties and responsibilities to take full advantage of the functionality and benefits that RIMIS offers agencies in the Delaware Valley.

In order to maximize this resource, agencies will need to implement a consistent training program so that:

- Operators at traffic operations and management, transit and emergency management/law enforcement are fully trained in how to use RIMIS functions and features.
- Operators and dispatchers are trained in how to input, interpret and act upon RIMIS information consistent with the policies and procedures of their respective agencies.
- Managers and supervisors are made aware of what kinds of information are available through RIMIS and how that information impacts their respective agency’s operations.

Because RIMIS will be implemented in phases, partner agencies must commit to periodic and ongoing training and capacity building for new RIMIS functions and features. As new staff join partner agencies, they too will need to be trained to operate and use RIMIS in support of their agency functions and operations. This will require development of a consistent regional training program that allows agencies to tailor the program to meet the specific needs of their staff, operating environment, and organizational structure. For example, a regional RIMIS training program may focus on the major features and functions of RIMIS, such as how to access information through the GIS map, view the calendar of planned activities, and initiate messages. Individual agencies will need to develop tailored training approaches so that operators, managers, IT staff, and other involved personnel know how to access and use these features within their current operating processes.

The objective of RIMIS is to support current agency operations, not disrupt or impede them. RIMIS will not require agencies to hire additional staff to operate or monitor the system, nor will it create the need to eliminate any current positions or staff. Agencies may however, require additional technical support, such as through their software provider or vendor, to make the necessary hardware and software modifications.

It is recommended that RIMIS partners review job responsibilities and duties for those staff that are anticipated to interact closely with RIMIS (particularly operators and dispatchers) so that the partners can make appropriate adjustments or modifications to those duties and responsibilities.

7.2.2 Policies and Procedures

As a regional data-sharing tool, RIMIS will require that policies and procedures will be in place among agencies to address key data sharing parameters, including:

- Types of data to be shared
- Which agencies will be responsible for providing data
- Data quality parameters
- Data frequency parameters
• Data privacy and security
• Information archiving and storage.

At the regional level, consistent policies and procedures will need to be in place for RIMIS to be an effective management resource. At an agency level, additional policies, practices, and procedures governing data and information sharing must be developed. Appropriate entities within partner agencies will need to be review these policies to consider legal, information technology, operational, and managerial perspectives.

7.2.3 Management of RIMIS

The DVRPC manages the development of RIMIS under the supervision of the RIMIS Subcommittee of the ITS Technical Task Force. In the future, RIMIS will require a permanent management structure and a formal agreement among the partnering agencies on how to fund and supervise RIMIS.

Possible management configurations include assigning management functions to one of the agencies; rotating management functions among the agencies (e.g., yearly); contracting with a consultant to manage RIMIS administrative functions; hiring limited staff to oversee RIMIS; or some combination of these. Two examples of multi-agency coordination are TRANSCOM and the I-95 Corridor Coalition. The initial concept for TRANSCOM relied on agencies donating staff to TRANSCOM for brief time periods, which minimized hiring additional staff and fostered a interagency cooperation. The I-95 Corridor Coalition relied on a combination of permanent staff for administrative work and consultants who provided oversight of technical activities. RIMIS management duties will include the following types of activities:

• Establish and periodically update a multi-year business plan
• Approve annual budget including capital and operating costs
• Apply for federal funding
• Develop and update cost allocation plan
• Hold policy and technical meetings with RIMIS participating agencies
• Participate in coordinate meetings with the agencies
• Establish performance measures to monitor the effectiveness of RIMIS
• Determine when additional enhancements to RIMIS are required
• Prepare Requests for Proposals (RFP) and contracts for outside venders to manage RIMIS and technical consultants to enhance RIMIS
• Coordinate training programs and regional operation initiatives.

7.2.4 Budgeting and Programming

Programming for near-term and ongoing RIMIS operations will be addressed at both the regional and individual agency level. A regional funding approach for RIMIS has not yet been determined. The DVRPC will serve as the lead for applying for funding support; some budgeting or budget allocation may be necessary at the local agency level for RIMIS integration.

Funding requirements for RIMIS will address:

• Initial implementation, including integration with existing systems
• Additional agency communication costs to support RIMIS
• Ongoing maintenance at the regional and local levels
• Staff training and periodic capacity building
• In-house and external technical resource requirements
• System enhancements and expansion, including extending RIMIS to work with additional types of devices (e.g., wireless)
• Periodic review of RIMIS functions
• Associated costs, if any, of adding new RIMIS partner agencies.
7.3 IMPACTS DURING DEVELOPMENT

Agencies in the Delaware Valley will need to be actively involved in the development, integration, testing, and implementation of RIMIS. This CONOPS outlines a decentralized system that features multiple development interfaces and options as RIMIS comes to fruition. A system developer/integrator should be retained for the technical aspects of designing and implementing RIMIS, and active participation by agencies should continue as the design and implementation progresses. RIMIS partner agencies need to anticipate:

- Participating in coordination and design development meetings, similar to “charettes,” where discussions can occur among multiple partners about key issues that affect the overall system
- Attending one-on-one meetings with the RIMIS developer to discuss specific interface requirements, logistics, and issues with local agency systems
- Involving procurement and risk management staff early in the process to begin assessing operational impacts to individual agencies, maintenance requirements and potential impacts, and contract administration issues
- Providing agency technical support for system development, installation, and integration
- Discussing training requirements at the regional and individual agency level, and agreeing on an appropriate training strategy
- Participating in table-top and technical exercises to run-through design features and conducting testing, reviews of operating capabilities, and demonstrations of key functions and features.

RIMIS development and integration will require participation from various users within RIMIS partner agencies, including operators/dispatchers, information technology and other technical resources, and managers/supervisors. These users will have the opportunity and responsibility to provide input into customization of RIMIS functions and features. Actual users of the system must be integrally involved in the development and testing because they will be most familiar with how RIMIS will integrate with existing systems and functions.
8.0 ANALYSIS OF THE NEW SYSTEM

RIMIS’s capabilities and features will be identified in detail during the functional requirements and implementation planning phases. This section of the ConOps will identify, describe, prioritize, and justify this feature set at a very high level. This section will also provide an analysis of the benefits, limitations, advantages, disadvantages, and alternatives and trade-offs of the capabilities or features considered for the proposed RIMIS system.
8.1 **Summary of Capabilities and Benefits of the New System**

The RIMIS system will benefit regional transportation management by reliably accelerating and broadening the exchange of information between participating agencies in the region. While the initial focus will be the exchange of transportation network status and incident information within a limited group of agencies, RIMIS is designed to be a modular and scalable system. These characteristics allow RIMIS to expand beyond its initial area of focus and to increase the number of participating agencies without the need for major systems redesign costs and effort. Ultimately, this expansion may mean partial or full integration of RIMIS participants within a larger ITS infrastructure.

Operationally, RIMIS will provide the potential to enhance the coordination of actions and resources when responding to regional incidents, special events, and unusually high congestion. It will also allow the transportation network to be managed on a more proactive basis. The latter can help further increase the transportation network’s capacity, accelerate travel in the region and increase traveler safety. For the region and the public as a whole, this translates into greater productivity as well as reduced accident and injury related costs.

While the RIMIS GUI is the visible component with which users will identify, RIMIS’ foundation is a non-visual messaging infrastructure that enables the exchange of information between participating agencies. The GUI simply provides one view, albeit an important view, into this messaging infrastructure.

The architecture of the messaging infrastructure is based on a publish-subscribe model. This design ensures that messages are routed through the network in an efficient and timely manner and that their delivery to subscribers is guaranteed. The choices of which predefined messages a RIMIS user may subscribe to will be determined by the RIMIS Metadata model, which will be defined as part of the RIMIS development effort. This model will help limit the volume of messages received by a particular RIMIS user, since it will help associate a RIMIS user with identified use cases and their related messages. RIMIS message subscribers may interact with RIMIS messages in one of two ways. They can either use the RIMIS GUI or, if their agency has written a direct interface to the RIMIS messaging infrastructure, they can incorporate RIMIS messages into their agency’s legacy systems. The latter option enables RIMIS messages to be combined with an agency’s own internal information stores in order to increase the value of RIMIS information. An example of this might be an application which subscribes to incident related messages in order to combine (RIMIS) provided coordinate data with other data found in the agency’s computing center.

This design of this messaging hub provides another significant benefit to both RIMIS and participating agencies in terms of the required level of effort for initial integration and subsequent maintenance. From an agency perspective, each is allowed to modify its’ own legacy systems as needed without reliance on any other agency. If an agency decides that it derives sufficient Return on Investment (ROI) from RIMIS through use of the RIMIS GUI alone, it can eliminate enhancements to its own systems altogether. If an agency decides it prefers integrating RIMIS messages in the operation of its legacy systems however, the example above illustrates a participating agency need only design a single message handling gateway, or interface, to achieve this. Once this interconnection is achieved through the design of the interface, all subsequent enhancements to a participating agency’s systems will likely be addressed by code enhancements that accommodate a specific RIMIS message set. From the perspective of the RIMIS development effort, the hub design also allows for a single design despite the fact that RIMIS data will be sent to a multitude of systems which utilize different technologies. RIMIS will receive and process any and all messages the same way regardless of the agency creating the message and whether it was done through the GUI or received directly through an agency’s interface. Once an inbound message is received, the publish subscribe capability is responsible for redistributing that and any given additional information to the current list of subscribers for that message type.

Since the reference point for most RIMIS users will be the RIMIS GUI, the above noted architectural details will remain largely transparent. The GUI interface will be built on browser based standards to facilitate deployment and minimize desktop software costs. Another advantage of using a browser based standard is that it can be combined with other open technology standards to allow RIMIS data to be
deployed to other types of devices, such as cellular telephone handsets. Some features of the GUI, like the message viewing queue, which closely resembles an e-mail application Inbox, will be a standard for all users. The content of what appears in the message queue however, will differ from user to user based on the type of messages to which the user subscribes. Other features that provide for customization and personalization will enable the user to customize the functionality to suit his/her work objectives. These customizations include the ability to aggregate content sources in a single browser such as CCTV streaming video and maps depicting incident locations and messages. Users will also be able to filter and organize messages in the Inbox.

Overall, the key benefits to operational personnel and to decision-makers are (a) access to broader and more reliable information to assess actions needed, (b) information keyed to map displays for better visualization of the “big picture” in high-pressure situations, and (c) more certainty (i.e., less risk) that needed communications are going out to agencies needing it, and that communications and data are arriving on a timely basis.

RIMIS would provide ready access to external information managed by other agencies when needed. This permits additional information to be factored into the response without causing an excessive delay. The map navigation interface enables each user to “zoom” in and out of the regional situation, and to visualize situations in the context of resources and conditions in the field. Even within each agency there may be simultaneous needs to visualize this context on a microscopic level as well as from “30,000 feet”. Finally, RIMIS enables communications to be broadcast or directed quickly and reliably. There is much less chance that communications breakdowns will occur – either because the need for communication is not recognized in a timely manner, or because a specific contact point is not available at a particular instant. Properly integrated with agencies’ internal systems, and with good planning of communications contingencies, RIMIS will provide and confirm “sure shot” messaging and information transmissions.

It is expected that many, if not all, of the essential features will be rolled out during the near-term implementation of the system. Deployment of this set of capabilities in the near-term will also help the objective of enhancing information sharing and coordination throughout the Delaware Valley Region.

The following capabilities matrices (Figures 8-1, 8-2, and 8-3) summarize essential, desirable, and optional user features for the planned new information-sharing system in relation to key justifications as identified in Section 4.

RIMIS will not be built upon existing agencies’ transportation management systems in the Delaware Valley, but it will be connected to them wherever agencies deem this to be appropriate. This connectivity will allow RIMIS to be developed with its own hardware components and stand alone capabilities without impacting existing agencies’ systems. RIMIS generated hardware and software upgrade cycles to existing systems at agencies will only be needed to the extent that an agency chooses to connect its legacy systems to the RIMIS infrastructure. This decision to implement this connectivity is likely to be driven by the message sets currently implemented in RIMIS and how these have functional overlap with existing agency systems.
<table>
<thead>
<tr>
<th>RIMIS System Justification</th>
<th>Minimize Fragmented Information</th>
<th>Reduce Redundant Communication</th>
<th>Eliminate Mis-Communication</th>
<th>Encourage Comprehensive Information Sharing</th>
<th>Support Real-time Traffic Data Sharing</th>
<th>Support Traffic Demand in Incident-Affected Area</th>
<th>Reduce Imprecise, Untimely, or Inaccurate Traveler Information</th>
<th>Provide Region with Functional Communications Backbone</th>
<th>Ensure Existing Inter-agency System Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>System security and protections</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expandable and customizable basic GUI</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Manual directed messaging</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Manual broadcast messages, alerts, and notifications</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incoming message bar</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Map-based transportation network display with display detail standards linked to zoom scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incident information and tracking functions, messages, alerts and notifications based on mode and jurisdiction</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 8-1
Essential RIMIS System Features
<table>
<thead>
<tr>
<th>RIMIS System Justification</th>
<th>Minimize Fragmented Information</th>
<th>Reduce Redundant Communication</th>
<th>Eliminate Mis-Communication</th>
<th>Encourage Comprehensive Information Sharing</th>
<th>Support real-time traffic data sharing</th>
<th>Support traffic demand in incident-affected area</th>
<th>Reduce imprecise, untimely, or inaccurate traveler information</th>
<th>Provide region with functional communications backbone</th>
<th>Ensure existing inter-agency system compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial traffic information service provider source traffic flow monitoring data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agency source traffic flow monitoring data/agency transit vehicle location and delay information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network ITS device status</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Planned closures (construction and maintenance) data</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Advance special events road closure/traffic pattern data</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Primary and secondary detour routes, contact names, and other data needed for pre-arranged detours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User class/user profile customizable display settings with network “data layer” filtering capabilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Message composition templates with pull-down menus for efficient and standardized addressing and information inputs</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Spatial analysis tools associated with the transportation network display</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Other scenario-based message templates, user groups, and resource-sharing support capabilities</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Automated broadcast or group alerts and messages of network status, incidents, and traffic conditions</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Data archiving to store messages, incident information, and transportation network data transmissions</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Agency source traffic camera video linked to graphical map display</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Figure 8-2
Desirable RIMIS System Features
<table>
<thead>
<tr>
<th>RIMIS System Justification</th>
<th>Minimize Fragmented Information</th>
<th>Reduce Redundant Communication</th>
<th>Eliminate Mis-Communication</th>
<th>Encourage Comprehensive Information Sharing</th>
<th>Support real-time traffic data sharing</th>
<th>Support traffic, demand in incident traveler information</th>
<th>Reduce Imprecise, untimely, or inaccurate traveler information</th>
<th>Provide region with functional communications backbone</th>
<th>Ensure existing inter-agency system compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Homeland Security (DHS) alert data</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Amber alert data</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Filtered 911 and emergency responder dispatch data that can be graphically plotted to display incidents impacting the transportation network</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Commercial traffic information service provider source traffic camera video linked to graphical map display</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Video teleconferencing among agencies</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Surface temperature/RWIS data</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Weather data</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Figure 8-3
Optional RIMIS System Features
8.2 DISADVANTAGES AND LIMITATIONS

In order to understand the potential disadvantages and limitations of RIMIS, a review of current communications technologies will serve to highlight how RIMIS may impact current response processes.

8.2.1 Review of current communication technologies

Current communications technologies handle two broad categories of messages. The first category consists of “basic” messages which deal with predictable daily operational events (e.g., pre-planned lane closures resulting from construction activity). This type of message may be computer generated given its predictability, and its’ message can be standardized to facilitate comprehension by RIMIS users. Since these messages typically confirm that events are occurring according to schedule, they have a relatively low operational value under routine conditions. Such messages are generally broadcast to a large number of recipients so each can take appropriate independent action within their agency’s jurisdictional boundaries.

The second category of message includes incident-related messages. This type of message has a much higher operational value because it identifies anomalies within the RIMIS operational boundaries. When an individual at an agency first learns of an incident, a resolution cycle is set in motion. The execution of this cycle is typically affected by the respondent’s level of experience, his/her analysis of the specific circumstances surrounding the incident, and factors beyond the immediate incident such as construction or road closures. These variables are synthesized by the individual and a predefined coordinated response cycle begins that has been modified to account for the unique circumstances of the unplanned event. Currently all response cycles are executed utilizing one, or a combination of, three basic communication models. These models are point to point (unicast) communication, selective group (narrow cast) and broadcast. The point to point model supports sequential step execution while the latter two permit process steps to be executed concurrently. The communication model (unicast, narrowcast, or broadcast) selected for use is key to the incident’s effective resolution and must chosen based on the particular class of incident.

All three communication models, regardless of whether they handle basic or incident-related messages, are currently supported by one, or a combination of, three messaging technologies. These are the telephone, fax machine, and e-mail. All three are rated in Figure 8-4 and briefly discussed below:

<table>
<thead>
<tr>
<th>Communication Model</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point to point</td>
<td>strong</td>
</tr>
<tr>
<td>Narrow Cast</td>
<td>acceptable</td>
</tr>
<tr>
<td>Broadcast</td>
<td>weak</td>
</tr>
<tr>
<td>Fax</td>
<td></td>
</tr>
<tr>
<td>Point to point</td>
<td>acceptable</td>
</tr>
<tr>
<td>Narrow Cast</td>
<td>acceptable-weak</td>
</tr>
<tr>
<td>Broadcast</td>
<td>weak</td>
</tr>
<tr>
<td>E-Mail</td>
<td></td>
</tr>
<tr>
<td>Point to point</td>
<td>strong</td>
</tr>
<tr>
<td>Narrow Cast</td>
<td>acceptable</td>
</tr>
<tr>
<td>Broadcast</td>
<td>weak</td>
</tr>
<tr>
<td>RIMIS</td>
<td></td>
</tr>
<tr>
<td>Point to point</td>
<td>strong</td>
</tr>
<tr>
<td>Narrow Cast</td>
<td>strong</td>
</tr>
<tr>
<td>Broadcast</td>
<td>strong</td>
</tr>
</tbody>
</table>

Figure 8-4
Current Messaging Technologies

1) Plain Old Telephone System (POTS)
Pros
- Strength is handling a point-to-point (unicast) communication model
- POTS infrastructure highly reliable
- No busy signals with appropriate number of phone lines
- Efficient - Verbal communication exchanges may rapidly convey messages and clarify issues surrounding an incident

Cons
- Audio only – provides limited informational “bandwidth”
- Archival of Audio content cumbersome to analyze for process improvement purposes
- Limited support for narrowcast model through conference calling, which is time consuming to set up and has practical limits to the number of participants

For many reasons, some messaging may always utilize voice technology at some phase of the resolution cycle. In this context, RIMIS can provide a positive background and follow-up mechanism for direct voice communication.

2) Facsimile (fax machine)

Pros
- Visual communication – provides higher informational bandwidth relative to telephone

Cons
- Transmission speed depends on communication line quality, the content being transmitted, and compression capabilities of each fax machine (i.e., Group II or newer Group III fax machines).
- Unable to broadcast information
- Cannot receive multiple messages simultaneously
- Best suited to handle communication situations in which the resolution process relies on sequential step execution
- Clarification of information using fax is typically slower than a POTS based message exchange
- Because several agencies do not have fax machines located in their operations centers, these agencies may not receive information in a timely manner.

3) Traditional e-mail

Pros
- Capable of supporting point to point, narrow cast and broadcast models
- Best suited for point-to-point based incident resolution requiring a simple sequential communication model
- Rapid message delivery with appropriate infrastructure
- Best broadcast capability

Cons
- Limited informational bandwidth unless combined with attachments
- Not well suited for managing incidents that require coordination of medium and large sized groups
- Risk of Information overload to users
- Determination of incident status difficult at any point in time due to potential e-mail “chatter”
- Synchronization of messages and chronology of actual incident related events not always clear
- Ad-hoc e-mail messages subject to the author’s writing style and reader’s interpretation. (Risk can be mitigated through use of predefined message)
- Time consuming to prepare unambiguous message
In summary, e-mail has some limitations but comes closest to providing a unified communications platform in the absence of a system like RIMIS

RIMIS introduces the use of a fourth communication technology, publish/subscribe technology, which capitalizes on the strengths of traditional e-mail while addressing some of its limitations. Unlike POTS and facsimile, publish/subscribe technology shares e-mail’s ability to utilize all three communications models. The use of predefined message sets and their association to RIMIS user classes allows messages to be narrow cast consistently and rapidly to RIMIS users while resulting in an overall streamlined flow of messages within RIMIS. This addresses the major weakness of e-mail technology since audience size grows within the context of an incident response situation and potential e-mail “chatter” increases. Lastly, unlike e-mail, predefined messages can be systematically prioritized to allow users to focus on the highest priority items as they enter a user’s message queue.

The potential disadvantages and limitations of RIMIS results from its impact on the existing three communication models and the desire of each agency to phase in its use of RIMIS at its individual pace. Additionally, the options of deploying RIMIS as a browser based solution, a messaging system that integrates directly with in-house legacy systems in some manner, or a combination of both presents an additional complicating factor in its usage.

The disadvantages and limitations of the above may be manifest in two areas. The first is the short term disadvantages and limitations to each organization and its processes. The second is longer term limitation that is imposed on the technology.

8.2.2 Disadvantages and limitations to the organization and processes

In the short term, the use of a new messaging technology may complicate operations for agencies using RIMIS. Instead of serving as a unifying messaging platform with which all agencies can share and coordinate information, RIMIS will be delegated to serve a fourth communication option. This implies that whenever a group of agencies coordinates the resolution of an incident, those agencies not using RIMIS will need to be incorporated in the cycle with one of the three other current communication technologies. These “off-line” agencies will therefore become the weakest link in the RIMIS incident response cycle, and the goal of achieving a unified messaging platform with RIMIS will be delayed for other member agencies. This short term increase in communication fragmentation however, is only marginally worse than the one already found in today’s incident resolution cycle, since some operation centers have access to fax machines while others only have access to e-mail or telephones. Although RIMIS brings additional complexity, because it offers another mode of communication; its magnitude and consistency of information will surpass the information available by telephone, e-mail, or fax.

8.2.3 Disadvantages and Limitations of the Technology

The long term disadvantages and limitations of the technology also result from the likely implementation plan rather than as an inherent limitation in the system’s design. It is likely to become evident as the RIMIS community expands.

The prospect of successfully integrating RIMISnet into a larger ITS infrastructure in the future will depend in part on RIMIS’s capacity to process an increased volume and variety of message. This processing not only refers to the successful conveying of messages using RIMISnet technology, but also the ability of RIMIS users to read, analyze and properly respond to incoming messages. Under the current deployment scenario, the growth in message volume may generate a need for increased staff at each agency in order to process RIMIS messages. An alternative to increased staffing may be to allow select lower priority pre-defined messages to be processed with some degree of automation. The success of this automation implies that the criteria and threshold for of an incident requiring manual intervention may need to be revisited over time to enable an increasing number of events to be handled with a lower level of RIMIS user interaction. This will allow the staff of member agencies to better focus their attention on the remaining non-automated messages and enact more proactive traffic management strategies.
To increase the automation of message processing, RIMIS agencies should also consider sending selected information from their internal system to other RIMIS agencies as well as receiving and processing incoming messages from other RIMIS agencies within their own systems. Some agencies have indicated that IT security concerns or technical considerations may preclude some agencies from embarking on such a tight integration path with RIMIS. If the RIMIS publish-subscribe model cannot be extended to incorporate the information found within the computer systems of member agencies, the RIMIS return on investment may fall short of its potential since RIMIS will exist as a segregated data store. The weakest link in this future information sharing scenario will be those agencies that continue to rely on relatively greater manual intervention for the processing of messages that address lower priority messages. From another perspective, if the RIMIS browser cannot be accessed at a user’s primary PC in within an operations center and its use requires a walk over to a standalone PC, users will be forced to switch repeatedly between workstations to perform their work. This burden represents a disincentive to use RIMIS and increases the risk that critical information may not be responded to in a timely manner.

The selected technology solution for RIMIS will emphasize the use of established open standards, such as XML, to provide the broadest possible choice of vendors. This will not only decrease RIMIS development costs, but it also will facilitate the effort that RIMIS member agencies must make to integrate their systems with RIMISnet. Member agencies all have unique technology portfolios, varying levels of concern for security, and differing amounts of resources with which to build their desired RIMIS interface. This technical diversity and related considerations will be the biggest long term challenge to the success of RIMIS. At this point in the RIMIS lifecycle, we cannot foresee specific technical difficulties and those obstacles that each DVRPC member agency will experience. Strictly speaking, identifying the difficulties specific to each agency is not within the scope of RIMIS. They represent however, a significant unknown and a potential barrier to the successful deployment of RIMIS.

A message-based system will minimize communication costs. Agencies will continue to manually input data until they are ready to upgrade their legacy systems to NTCIP-compliant systems. In addition, NTCIP and IEEE standards offer a wide and flexible range of message sets. Initially, RIMIS will focus on a few critical message sets and slowly ramp-up the number of supported message types. The pace of implementation can match funding availability and agency technologies.
9.0 NOTES

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10.0 APPENDICES

10.1 ITS MESSAGE STANDARDS, COMMUNICATIONS STANDARDS, AND EXISTING REFERENCE MODELS

**RIMIS and Intelligent Transportation System (ITS) Standards**

To foster interoperability among operation centers and between operation centers and field devices, the Federal Government has promoted a set of ITS standards. These standards include data dictionaries, message sets, and communication protocols. Because ITS encompasses different disciplines, professional organizations responsible for traffic, transit, and emergency management have promulgated different standards that sometimes overlap.

Data dictionaries define basic data elements such as type of incident or type of road closure. Message sets are composed of strings of data elements or message sets that accomplish a function. For example, a message about a planned event may include data elements relating to the type of event, contact person, jurisdiction or facility, begin date, and end date.

Communication protocols establish how the messages can be exchanged and include profiles for message transfer, encoding, and error handling. Various standards for data transport have also been developed; however, a basic assumption of the CONOPS is that RIMIS will be TCP/IP-compliant.

ITS standards are constantly evolving as standard development organizations refine standards and as the standards are tested in actual deployments. Selecting which standards to use must balance federal requirements to use ITS standards with the maturity of the standard. Ideally, RIMIS will use standards that are stable and have been field-tested while monitoring constantly the status of ITS standards.

**Data Dictionary and Message Set Standards**

ITS integration seeks to enhance regional real-time situational awareness for agencies and effective management of the transportation networks that span multi-jurisdictional and multi-modal operations areas. RIMIS will help enhance inter-agency awareness and subsequent transportation network management as a major communications subsystem of the Delaware Valley. RIMIS is envisioned as a message-based, electronic information sharing system with decentralized and scalable subcomponent properties. The system will use established multi-jurisdictional and multi-modal ITS message standards. Because of their criticality for system interoperability, the message standards must have the following functional requirements and properties:

- Messaging consistency and compatibility with existing management data dictionary and message set standards
- Usage of data dictionaries and message sets applicable to different types of transportation and incident management centers
- Mapping and spatial referencing standards
- Data sharing interface and data transfer language standards that are consistent intra-regionally
- Data interface and message standard compatibility with extra-regional information-sharing systems.

**Message Set Standards**

The diverse ITS networks typically used by a region are built as specific applications that often employ unique or proprietary data definitions to meet immediate implementation needs. Such “closed architecture” legacy systems are generally not designed for data exchange interoperability between organizations in the current IT environment. Also complicating system interoperability, many different first responders to incidents, such as fire services, police, and emergency management system and emergency medical services groups, tend to have their own unique communications equipment and
standards related to CAD systems and “telemedicine” operations. To facilitate the efficient exchange of information, the standards development organizations have recommended uniformity with respect to various data elements, messages, and message sets using formats and templates in a manner that can deliver the desired level and consistency of future ITS interoperability and interagency communications.

RIMIS ITS and communication standards address the format with which the messages and real-time traffic data and operational information to be exchanged within the system. Selected ITS and communications standards, as well as specific messages, will be detailed in the creation of the system functional requirements. ITS and communication network standards are generally summarized and evaluated in the following subsections.

Relevant ITS Standards and How They Work

The relevant ITS standards enable the effective exchange of data and information necessary among the Delaware Valley’s Advanced Traffic Management System (ATMS) centers, and between those centers and ITS field devices and other centers.

Traffic Management Data Dictionary (TMDD)

The Institute of Transportation Engineers (ITE) produces the TMDD Center-to-Center Concept of Operations and Requirements Standard on behalf of the FHWA. This standard enables concepts from traffic management to be defined and used in the same way by different systems and centers. The TMDD Standard (ITE TM 1.03) comprises common data definitions called “data elements.” These data elements relate to operation center-to-field device communications and are organized into four sub-sections: 1) Links and nodes; 2) Events, incidents, and notification alarms; 3) Data elements for traffic network, traffic signal control, traffic detectors, ramp meters, traffic modeling, and vehicle probes; and 4) Data elements for closed circuit television, dynamic message signs, environmental sensor stations, gates, and HAR.

RIMIS will help agencies exchange information and coordinate operations, especially for traffic and incident management. Therefore, the two most relevant TMDD data element subsections are the “Traffic Network” and “Events Affecting the Traffic Network.”

ITE submitted TMDD Interim Version 2.1 for approval in February 2005. Version 2 is consistent with the TMDD used by TRANSCOM and several other C2C deployments. More substantial changes are anticipated in Version 3 as the TMDD Steering Committee attempts to harmonize the TMDD with NTCIP protocols.

Transit Communications Interface Profiles (TCIP)

The CONOPS outreach process has identified the need for information on transit delays, incidents, and coordination.

TCIP is a suite of ITS standards developed for the transit industry. TCIP framework (NTCIP 1400) establishes the general framework and protocols for ITS transit standards. Eight business area object standards deal with various facets of the transit industry. Those standards most applicable to RIMIS include:

- TCIP Common Public Transportation Objects (NTCIP 1401). Defines those data elements that are generic to multiple TICP business areas.
- TCIP Incident Management Business Area Standard (NTCIP 1402). Defines data elements and messages used for exchanging information on incident management operations.
- TCIP Passenger Information Business Area Standard (TCIP 1403). Defines data elements and messages used for passenger information data exchanges.

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8 ITE and AASHTO, July 2003, TMDD & MS/ETMCC, Guide-Version 1.0.
• TCIP Scheduling/Runcutting Business Area Standard (TCIP 1404). Defines data elements and messages used to exchange information about transit schedules.
• TCIP Spatial Representation Business Area Standard (NTCIP 1405). Defines data elements and messages used to exchange location and spatial concepts.
• TCIP Control Center Objects (NTCIP 1407). Defines data elements and messages for exchanges between control centers.

An NTCIP Joint Committee developed the framework for TCIP standards and has begun developing draft standards. In November 2003 the NTCIP Joint Committee recommended that American Association of State Highway and Transportation Officials (AASHTO), ITE, and National Emergency Management Association (NEMA) rescind the TCIP standards and transfer the documents to American Public Transportation Association (APTA).

**Advanced Traveler Information Systems (ATIS) Data Dictionary (SAE J2353)**

While RIMIS primary focus is C2C incident information, traveler information is a secondary objective. Disseminating information to information service providers and from them to the public is the initial concept. The public eventually may have limited access to the RIMIS database.

ATIS Data Dictionary provides a set of core data elements that information service providers need. It covers all stages of travel, including pre-trip and en route traveler information. It also covers all types of travelers, including drivers and transit passengers. To facilitate traveler information, the data dictionary includes items for all types of travel information dissemination platforms, including in-vehicle devices, portable devices, and kiosks.

The Society of Automotive Engineers published the standard, which has not been updated, in 1999.

**Message Sets for External Traffic Management Center Communications (MS/ETMCC)**

That MS/ETMCC Standard (ITE TM 201) anticipates that each center will have its own unique messages it wants to send and receive. This standard focuses on the “traffic management” application message sets for use in exchanging information between centers and field equipment and other regional ITS “terminators.” These messages are grouped and organized to establish uniform information interpretation within the local system environment and regional-level transportation management centers. The organization of the MS/ETMCC standard is subdivided into six groupings: roadway-network, network-state, network-events, traffic-requests, traffic-device-status, and traffic-control.

After an initial analysis of the MS/ETMCC standard, the most relevant message set element sub-groupings are: administrative messages (organization and contact information), event messages, CCTV messages, DMS messages, and traffic detector information. All MS/ETMCC message sets and individual messages to be adopted by RIMIS will be specified in the RIMIS Functional Requirements Document (FRD).

Both the TMDD and MS/ETMCC are communication protocol-neutral; DATEX, CORBA, and XML can be used to encode them. MS/ETMCC is based on the data elements contained in the TMDD. Both standards are being jointly developed by the same standard development organizations. Therefore, similar to the TMDD, ITE has placed MS/ETMCC Interim Version 2.1 up for approval in February 2005.

**Message Sets for Advanced Traveler Information Systems (SAE J2354)**

This standard contains message sets needed by information service providers for advanced traveler information systems. It is based on the ATIS Data Dictionary established in SAE J2353. The messages address all stages of travel (pre-trip and en-route), all types of travelers, all categories of information, and all platforms for delivery of information (e.g., in-vehicle, portable devices, and kiosks).

SAE J2354 was published by the Society of automotive Engineers in 2004.
**Incident Management (IEEE 1512) Standards**

Incident management standards were developed by the Incident Management Working Group (IMWG) representing the transportation industry, law enforcement, fire and rescue services, emergency medical services, HAZMAT responders, shippers, and developers who build CAD and ATMS systems. The 1512 standards facilitate interoperability between transportation management systems and public safety communication systems. The standards provide a common language specification that can be used by dissimilar systems to exchange critical items of information.

The basic standard 1512-2000 is a data dictionary and message set that can be used to handle transportation incident management in a multi-agency environment. Standard 1512.1 adds supplemental standards to describe work zones, traffic control plans, traffic management assets (such as VMS), and network conditions. Standard 1512.2 adds additional public safety features; it describes public safety-specific warning information, situational awareness, plan dissemination and inter-agency asset management. Standard 1512.3 adds functionality to cover HAZMAT situations.

The 1512 family of standards are compatible with XML schema. IEEE 1512 incorporates relevant portions of the TMDD and SAE ATIS data dictionaries. Standard 1512-200 was published in 2000; 1512.1 in 2003; 1512.2 in 2004; and 1512.3 in 2002. Portions of the standards have been used by the CapWin Project in the Washington, DC Metropolitan Area and by the Integrated Incident Management System (TTMS) in New York City.
10.2 COMMUNICATION NETWORK STANDARDS

Center-to-Center (C2C) Protocols

Successful data exchange between centers requires the involved centers to agree on several key items, such as the following:

- The mechanism, or message patterns, by which a message is requested or triggered. Message patterns, also referred to as message dialogs, define the relationships between messages.
- The structure of the message, which defines the data elements that make up a message. Structures are catalogued in a message set. ITS SDOs are developing message sets based on the transportation functional area.
- The definition of data elements in the requested message (e.g., Incident Type 3 means an accident involving at least one fatality). Data elements are defined in a data dictionary. SDOs have defined data dictionaries for various transportation functional areas, such as transit, traffic management, traveler information, archived data, and emergency/incident management.
- The rules used to encode the data into computer readable format.
- The transmission protocol used to transmit the message between one computer and another.

For the purpose of this discussion, a “center” is a computer. C2C communications involve data exchange between computers. A computer may be in a traffic management center, a transit management center, a traveler information center, an incident command or emergency management center, or related areas. A wide variety of data can be sent from one center or computer to another.

NTCIP originally provided two alternative application-level protocol choices for C2C (C2C) communications, DATEX-ASN and CORBA. More recently, because of its simplicity and the wide accessibility of tools provided by these services, C2C links using XML and related technologies are being adopted. By determining where to deploy each protocol (with some centers acting as translators between the different protocols), all of these protocols can be used in the same network.

Data Exchange (DATEX)

DATEX provides a general purpose C2C data exchange protocol stack. It uses pre-defined messages transmitted by the base Internet protocols (TCP/IP and UDP/IP) in a peer-to-peer network. DATEX ASN.1 is primarily an application layer formatting protocol that encodes data based on the definitions of the Abstract Syntax Notation (ASN), a standard defined by the International Standards Organization (ISO). In order to encode data using ASN, another layer of data encoding is necessary to translate the data values expressed in ASN in the proper sequence of bits and bytes. This latter protocol layer is referred to as the “presentation layer” and may take one of several forms, such as BER, PER, and OER. Although the details of the presentation layer are not important to this discussion, they point out some of the complexities inherent in selecting a “standard” protocol.

NTCIP developed several preliminary standards to implement DATEX OER–based systems. TRANSCOM’s Regional ITS Architecture is an example of a DATEX-based platform.

Common Object Request Broker Architecture (CORBA)

CORBA is a general-purpose C2C communications protocol based on the computing industry standard of the same name. For object-oriented systems, it enables a higher degree of integration and some services not provided by DATEX; however, CORBA may not be suitable for near real-time applications and loosely-coupled systems.

CORBA definitions have existed since the early 1990’s and are currently under the purview of Object Management Group, Inc. NTCIP adopted CORBA as one of the C2C protocols that may be used for ITS purposes, but NTCIP does not manage the details or versions of CORBA. CORBA primarily refers to a
transport layer protocol, within which is encapsulated an application layer protocol. In CORBA, the well-defined transport layer provides the mechanisms to send and receive data packages, although different versions of CORBA may not be fully interoperable. CORBA does not define application layer details (i.e., the subject-matter information), requiring the implementation (i.e., the project) to define them.

**Extensible Markup Language (XML)**

NTCIP recently adopted XML in response to its popularity in various Internet applications. Similar to ASN, XML provides a means of formatting information, but does not provide definitions for how to handle subject matter information. XML is a means by which one computer can encode some information (data) so that another computer receiving that encoded information will be able to understand its contents and act on that content. Message sets can be defined by an XML schema. One advantage provided by XML is that it uses ASCII (alphanumeric) text to format the data, making it easy for users to read information in a message buffer without resorting to deciphering hexadecimal numbers. Another advantage of XML is that it allows the implementation to define how data items will be formatted or organized, in effect providing the versatility to format and arrange data in any structure that is appropriate or convenient for the implementation. Conversely, this versatility does not provide the benefits of a rigidly defined standard. Note that XML, in itself, does not define dialogues and delivery or subscribe and publish mechanisms and protocols. Unlike C2C protocols such as DATEX-ASN and CORBA, XML also does not establish login/logout capabilities, security protocols, and other services and functionality.

Most of the more recent projects to implement C2C communications have used XML as their platform. TRANSCOM's Region ITS Architecture, which is DATEX-based, is being converted into XML format to facilitate a web-based version of its GUI. NTCIP is developing draft application profiles for XML through NTCIP 2306 (Application Profile for XML Message Encoding and Transport in ITS C2C Communications). This involves the use of Simple Object Access Protocol (SOAP) and Web Services Description Language (WSDL). The draft standard supports both subscription services and action requests sent to another center. Under the standard, actual message content is defined by other standards, such as TMDD, MS/ETMCC, SAE J2354, and IEEE 1512.

In relation to the anticipated RIMIS concept, the most relevant C2C protocol may be XML.

**The National Transportation Communications for ITS Protocol (NTCIP)**

The NTCIP family of standards defines general purpose communications protocols, transportation-specific data dictionaries, and message sets that computer systems and field devices use in transportation management. These standards facilitate the ability to establish one communications network for all purposes. NTCIP allows a management system to communicate with a mixture of device types on the same communications channel. NTCIP applications generally fall into two categories: Center to field (C2F) and center to center (C2C). C2F involves devices, normally located at roadides, that communicate with management software on a central computer. C2C applications usually involve computer-to-computer communications where the computers reside in the same room, in management centers operated by adjacent agencies or in management centers across the country. It is anticipated in this concept that the majority of the NTCIP applications and standards adopted by RIMIS will address C2C and only to a small extent C2F.

**NTCIP Communications Levels**

NTCIP communications levels are similar to the layering approach that has been adopted to make the Internet work the way it does and to approaches adopted by the ISO. NTCIP uses a modular approach to data communication between two computers that establishes a layered hierarchy organization of data exchange levels. The NTCIP layered hierarchy consists of the following five levels:

**Information Level** – Information standards define the meaning of data and messages and generally deal with ITS information (rather than information about the communications network). This is similar to defining a dictionary and phrase list within a language. Information level standards represent the functionality of the system to be implemented.
Through a layered combination of existing communications standards and a few new standards developed specifically for ITS, NTCIP provides a family of communications protocols that serve many of the common needs in transportation management. This level contains standards for the data elements, objects, and messages to be transmitted (e.g., TCIP, NTCIP 1200 series Standards Publications, TMDD, and MS/ETMCC). The information level standards used in ITS are unique to the transportation industry.

**Application Level** – Application standards define the rules and procedures for exchanging information data. The rules may include definitions of proper grammar and syntax of a single statement, as well as the sequence of allowed statements. This is similar to combining words and phrases to form a sentence or a complete thought and defining the rules for greeting each other and exchanging information. This level contains standards for the C2C protocols, such as DATEX ASN, CORBA, and XML.

**Transport Level** – This level contains standards for data packet subdivision, packet re-assembly, and routing when needed (e.g., TCP, UDP, and IP).

**Subnetwork Level** – This level contains standards for the physical interface (e.g., network interface card) and the data packet transmission method (e.g., HDLC, PPP, Ethernet, and ATM).

**Plant Level** – This level consists of the physical transmission media used for communications (e.g., copper wire, coaxial cable, fiber optic cable, and wireless).

The RIMIS concept anticipates that the most relevant NTCIP application and standards will be at the information and application levels. The RIMIS functional requirements will document all NTCIP applications and standards to be used by RIMIS and will not categorically ignore any of the five communications levels.

**Summary**

A baseline constraint for RIMIS is that the data sharing interfaces and data transfer languages must be consistent. Under the evolving RIMIS concept, the new system will automatically extract ITS data from various agency data sources or designated IP addresses in a non-intrusive and secure manner, and then share them with the rest of the community. These constraints will be addressed through the use of ITS data dictionaries and message sets, as well as the communications protocols as described in this document.

The objective is for RIMIS to help agencies exchange information and coordinate operations, especially those related to traffic and incident management. Therefore, the two most relevant TMDD data element subsections are Traffic Network and Events Affecting the Traffic Network.

After an initial analysis of the MS/ETMCC standard, the most relevant TMDD data element sub-groupings are traffic control, network-events, and traffic-device-status. All MS/ETMCC message sets and individual messages to be adopted by RIMIS will be specified in the RIMIS FRD. IEEE 1512 standards will also be incorporated into RIMIS.

In relation to the anticipated RIMIS concept, the most relevant C2C protocol may be XML.

**Possible Linear Reference Models (separate from encoding reference models)**

This section explores existing types of systems that can be used as the RIMIS linear reference model. This discussion includes a description of two well-known software solutions: Intelligent Road and Rail Information Server (IRRIS) and SmartNET.

IRRIS provides the most comprehensive source of information and presents interesting opportunities for creating relationships between geospatial coordinates. SmartNET is a proven ITS solution that combines the ability for users to create TMDD-based messages and to interface with the automated sources of data from systems in transportation operations and public safety 911 centers.
**Location Referencing Message Specification (LRMS)**

The Location Referencing Message Specification (LRMS) is a spatial referencing standard describing a set of standard interfaces for the transmission of location references among different components of the ITS. Revision B of the standard dates back to 1997, and it is currently used by ITS system developers, information service provider designers, GIS system vendors, and vehicle navigation map providers. The standard is divided into seven distinct profiles, each identifying the major items of interest to users of this type of information.

**Intelligent Road and Rail Information Server (IRRIS)**

The IRRIS system was originally developed for the Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) by GeoDecisions. The company suggests that future deployments of the system for transportation agencies either hosted by GeoDecisions or implemented on local servers at the agencies.

**System Operations and Maintenance**

IRRIS emphasizes the integration of data from multiple sources. The system developer, GeoDecisions, is responsible for ensuring that the data used in IRRIS remains up to date and the real-time data feeds remain available.

Users can select the data layers that are displayed on the map and can view and query the information available. Data from the various sources is then displayed on the map. Users can pan a map and can zoom in and out on the map display. Other data, such as video logs, CCTV camera images, or linked web pages, is displayed in separate windows on the browser. Query tools are also available to the user. These tools allow the user to select specific features (such as all bridges with clearance less than 5 meters) from the current view or from all data. Spatial queries can also be performed to return specific information (such as in the event of an incident finding all hospitals or police departments within 5 miles). These selections can be made in reference to a point, circle, or polygon. Users also have access to a point-to-point routing tool. Routing can be based on selecting points from the map, addresses, or facilities, such as airports. IRRIS also contains shipment and vehicle tracking tools.

**GIS Base Map**

IRRIS is billed as a “geospatial warehouse” using Oracle’s Spatial and Active Server Page (ASP). This allows data from multiple sources to be geospatially related and presented on a single map display. Consequently, IRRIS can accept data from any GIS platform used by an agency.

**User Interface**

The user interface is a web browser. The user can define the map display based on:

- Highway
- City
- Rail line
- Port
- Street address
- Zip code
- Latitude/Longitude.

**Information Available to Users**

IRRIS comprises approximately 130 data layers that can be presented to the user. Data of most significance to transportation agency users include:

- Weather (alerts and forecasts)
- Facilities and infrastructure
• Hospitals
• Federal Emergency Management Agency (FEMA) locations
• Fire and police locations
• Traffic data, including traffic speeds, incidents, and CCTV images
• Point-to-point routing
• Aerial photographs
• Video logs.

**SmartNET**

SmartNET is a web-based traffic management system developed by PB Farradyne. The system supports operational management and data entry of incidents, construction events, and special events from traffic management centers and other off-site locations. As a web-based solution, any authorized user with Internet access can view or enter information in the system. The system is intended to support better coordination of incidents and planned events by public agencies.

**System Operations and Maintenance**

A key aspect of SmartNET operations is data entry by users. SmartNET allows entry from any computer with access to the Internet. Users select locations for the various events from pop-down menus. Events at these locations are then described by selecting phrases from the TMDD via pop-down menus to avoid manual typing of phrases and descriptions.

Tools available to the users include the following:

- *Highway and transit incident tracking*—Provides an interface for data entry to create an event description for submission to other web clients.
- *Highway and transit planned construction*—Provides an interface for data entry to create a construction event description, together with multiple schedules for the event.
- *Highway and transit planned special event*—Provides an interface for data entry to create a special event description, together with multiple schedules for the event.
- *Alarms*—Provides an interface to alert users of events submitted by other agencies, and suggested alarms from other systems.
- *Fax, pager, e-mail interface*—Provides the ability to send event descriptions to users that do not have Internet access.

**GIS Base Map**

The SmartNET system is implemented using the MAGIS GIS database, which is used by New York State Department of Transportation (NYSDOT) Region 3. Because SmartNET uses ArcIMS the system can integrate using any GIS or mapping system.

**User Interface**

Users can view information on a map display that can be panned and zoomed or view a list of events with their descriptions. On the map display, users can select the levels of roadway to be displayed. Different event types can also be displayed together or separately at the user’s choice. Events are displayed on the map as icons, which can be clicked to display the event in text form. Alarms can be viewed as scrolling messages on the user display. Alarms can also be opened in a separate window to let the user read the full text message.

**Information Available to Users**

The information available to users is based on the message sets in the TMDD. Typical information available through SmartNET includes:
• Planned events
• Construction activities (planned and active)
• Athletic events
• Parades
• Incidents
• Accidents
• Road and lane closures
• Congestion
• Weather-related road and driving conditions
• Amber alerts.

The selection of either SmartNET or IRRIS as a key component of RIMIS hinges on each product’s compatibility with the final RIMIS architectural specification. On the surface, the user interface of both products displays information through a web browser. From a technical perspective both products rely on HTML to render the user interface. How this HTML is rendered or created is not immediately apparent and require a more detailed analysis as part of Work Orders 2 and 3 (once the definition of the RIMIS architecture is completed).

In addition to direct RIMIS compatibility, trends within the evolution of LRS technology deserve more detailed consideration as part of any recommendation. For example, compatibility with ISO 19133, which is in Final Draft Information Status (FDIS), and the National Spatial Data Infrastructure (NSDI) Framework Standard for Transportation are two variables that should be weighed in order to make a recommendation. The latter standard, which has not been submitted for approval yet, is in draft format and may change slightly. NSDI was developed in coordination with Federal Government (DOT/BTS is a committee member), state and local governments, and the industry. NSDI standard includes Geographic Markup Language (GML), a dialect of XML and an open standard that easily integrates with technology platform envisaged for RIMIS. The current version (v2.0) of the specification formally bears the status of "adopted specification" within the Open GIS Consortium (OGC).

The GML specification is maintained by the GML Revision Working Group within the OGC. Compliance with these two evolving technical standards may make other options more attractive.
# 11.0 GLOSSARY

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<tr>
<th>Acronym</th>
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<td>AAA</td>
<td>American Automobile Association</td>
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<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<td>APTA</td>
<td>American Public Transportation Association</td>
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<td>ATIS</td>
<td>Advanced Traveler Information System</td>
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<td>ATMS</td>
<td>Advanced Traffic Management System</td>
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<td>Automatic Vehicle Location</td>
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<td>Center-to-Center</td>
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<td>Delaware Valley Highway Operations Group</td>
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<tr>
<td>DVRPC</td>
<td>Delaware Valley Regional Planning Commission</td>
</tr>
<tr>
<td>EMS</td>
<td>Emergency Medical Services</td>
</tr>
<tr>
<td>ESP</td>
<td>Emergency Service Patrol</td>
</tr>
<tr>
<td>E-ZPASS</td>
<td>Electronic toll collection system used by a consortium of toll authorities in northeast United States</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>GVFTMA</td>
<td>Greater Valley Forge Transportation Management Association</td>
</tr>
<tr>
<td>HAR</td>
<td>Highway Advisory Radio</td>
</tr>
<tr>
<td>HAZMAT</td>
<td>Hazardous Materials</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
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</tr>
<tr>
<td>IEN</td>
<td>Information Exchange Network</td>
</tr>
<tr>
<td>IMRT</td>
<td>Incident Management Response Team</td>
</tr>
<tr>
<td>ISP</td>
<td>Information Service Provider</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electronic and Electrical Engineers</td>
</tr>
<tr>
<td>IIMS</td>
<td>Incident Information Management System</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organizations</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>ITE</td>
<td>Institute of Transportation Engineers</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation System</td>
</tr>
<tr>
<td>LRMS</td>
<td>Location Reference Messaging Standard</td>
</tr>
<tr>
<td>MS/ETMCC</td>
<td>Mess Sets for External Traffic Management Center Communications</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NJDOT</td>
<td>New Jersey Department of Transportation</td>
</tr>
<tr>
<td>NJSP</td>
<td>New Jersey State Police</td>
</tr>
<tr>
<td>NJT</td>
<td>New Jersey Transit</td>
</tr>
<tr>
<td>NJTA</td>
<td>New Jersey Turnpike Authority</td>
</tr>
<tr>
<td>NTCIP</td>
<td>National Transportation Communications for ITS Protocols</td>
</tr>
<tr>
<td>NWS</td>
<td>National Weather Service</td>
</tr>
<tr>
<td>O &amp; M</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>OEM</td>
<td>Office of Emergency Management</td>
</tr>
<tr>
<td>PASP</td>
<td>Pennsylvania State Police</td>
</tr>
<tr>
<td>PATCO</td>
<td>Port Authority Transit Corporation</td>
</tr>
<tr>
<td>PCVB</td>
<td>Philadelphia Convention and Visitors Bureau</td>
</tr>
<tr>
<td>PEMA</td>
<td>Pennsylvania Emergency Management Agency</td>
</tr>
<tr>
<td>PennDOT</td>
<td>Pennsylvania Department of Transportation</td>
</tr>
<tr>
<td>POC</td>
<td>Point of Contact</td>
</tr>
<tr>
<td>POTS</td>
<td>Plain Old Telephone System</td>
</tr>
<tr>
<td>PPA</td>
<td>Philadelphia Parking Authority</td>
</tr>
<tr>
<td>PSP</td>
<td>Pennsylvania State Police</td>
</tr>
<tr>
<td>PTC</td>
<td>Pennsylvania Turnpike Commission</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposal</td>
</tr>
<tr>
<td>RIMIS</td>
<td>Regional Integrated Multi-modal Information Sharing</td>
</tr>
<tr>
<td>RWIS</td>
<td>Road Weather Information System</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
</tr>
<tr>
<td>SDO</td>
<td>Standards Development Organization</td>
</tr>
<tr>
<td>SEPTA</td>
<td>Southeastern Pennsylvania Transportation Authority</td>
</tr>
<tr>
<td>SJTA</td>
<td>South Jersey Transportation Authority</td>
</tr>
<tr>
<td>T-1</td>
<td>High Bandwidth Telephone Line</td>
</tr>
<tr>
<td>TCC</td>
<td>Traffic Control Center</td>
</tr>
<tr>
<td>TCIP</td>
<td>Transit Communications Interface Profiles</td>
</tr>
<tr>
<td>TIP</td>
<td>Transportation Improvement Plan</td>
</tr>
<tr>
<td>TMA</td>
<td>Transportation Management Association</td>
</tr>
<tr>
<td>TMC</td>
<td>Traffic Management Center</td>
</tr>
<tr>
<td>TMDD</td>
<td>Traffic Management Data Dictionary</td>
</tr>
<tr>
<td>TOC</td>
<td>Traffic Operations Center</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
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</tr>
<tr>
<td>TRANSCOM</td>
<td>Transportation Operations Coordinating Committee</td>
</tr>
<tr>
<td>TRANSMIT</td>
<td>TRANSCOM Probe Surveillance System for Determining Travel Speeds</td>
</tr>
<tr>
<td>TTF</td>
<td>Technical Task Force</td>
</tr>
<tr>
<td>US DOT</td>
<td>United States Department of Transportation</td>
</tr>
<tr>
<td>VMS</td>
<td>Variable Message Signs</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
</tr>
</tbody>
</table>