

Attachment 6
Concept of Operations
ATMS RFP

New York State
Department of Transportation
Advanced Traffic Management System

April 25, 2012

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1. PURPOSE OF DOCUMENT

This document addresses the New York State Department of Transportation's (NYSDOT) needs with respect to a statewide, standardized approach to the deployment of Advanced Traffic Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS). The document provides a description and rationale of the expected operations of these systems. It is a vehicle for stakeholder discussion and consensus to ensure that the system that is built is operationally feasible.

This document has been developed on behalf of NYSDOT's Office of Traffic Safety and Mobility. The Office wishes to identify a statewide platform for transportation management and traveler information. The audience for the document includes all NYSDOT stakeholders (see Section 6.1), at both the regional and main office levels, involved with traffic management.

2. SCOPE OF PROJECT

NYSDOT is seeking a statewide, standardized approach to transportation management and traveler information. Specifically, this includes Advanced Traffic Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS). Traditionally ATMS refers to systems that consolidate the command and control functions of field equipment original equipment manufacturer (OEM) software (e.g., VMS management and camera viewing and control). ATIS refers to incident management and traveler information reporting functions, and the display of traveler information to the public. Some existing deployments have blended these two principle functions into a single graphical user interface (GUI).

In seeking a statewide, standardized approach to transportation management and traveler information, NYSDOT is looking to achieve the following:

- Cost savings associated with migrating from the current state of multiple disparate software applications to one ATMS with anticipated savings in the areas of software maintenance and support
- Provision of ongoing software support and maintenance
- Potential for future in-house NYSDOT IT support
- The extension of features and functionality to smaller regions that are not in a position to make significant investments in ATMS/ATIS software on their own
- The ability of regions to cover each other during emergencies
- The standardization of core processes, procedures, and performance measures across regions
- Better visibility into regional traffic management operations for the Statewide Transportation Information and Coordination Center (STICC) and the option for the STICC to provide backup services to the regions

The following factors will likely challenge the ability of NYSDOT to move to a statewide, standardized approach to transportation management and traveler information in a single phase of effort:

- Significant investments have already been made in existing ATMS/ATIS in the regions, and there will likely be "cultural" resistance and practical issues that will prevent these regions from immediate deployment of a new statewide software application.
- The current funding environment is not conducive to the level of investment that would be required to acquire a statewide software application.

It is expected that movement toward a statewide, standardized approach will need to be conducted through multiple phases. Given the current status of their ATMS/ATIS, Region 3 (which currently has no ATMS/ATIS) and Region 8 (whose current ATMS/ATIS is not meeting needs and is not supported) are the primary candidates for an initial deployment.

3. REFERENCED DOCUMENTS

In preparation for this report, the following documentation was reviewed:

- NYS Intelligent Transportation System (ITS) Strategic Plan
- Regional ITS Strategic Plans
- Other NYSDOT background information provided by NYSDOT's main office, including Traffic Management Center (TMC) related costs and deployed field equipment inventory.

A series of interviews and site visits were conducted with all regions, as well as with main office staff and other stakeholders. The following questionnaires were completed by all regions:

- NYSDOT Regional TMC Operations Interview Form
- ATMS Functionality Survey
- NYSDOT Traffic Management Systems Deployment Summary

The following table provides details on the interviews conducted:

Interviews	TMC Site Visits
<i>Regions:</i>	<i>Small:</i>
Regional Director (RD), Regional Director of Operations (RDO), Regional Traffic Engineer (RTE) (and staff) – each Region	Region 9
TMC Managers (and staff) – each Region	<i>Medium:</i>
<i>Main Office:</i>	Region 1
<i>Statewide Traffic Management and STICC perspective (OTSM, ITS, SOB, ETO)</i>	<i>Large:</i>
<i>Federal Highway Administration (FHWA) perspective (NY Division)</i>	Regions 8 & 10
<i>Public Safety perspective (New York State Police - NYSP)</i>	
<i>Statewide Operations Division perspective</i>	

4. BACKGROUND

4.1 TMC Activities

The functions of an ATMS/ATIS need to be based on TMC activities. The following descriptions of TMC activities have been identified by NYSDOT:

At the highest level, TMC activities fall into the following categories:

- Monitor transportation system and manage traffic demand in real time
- Detect traffic incidents and expedite safe and efficient response and removal
- Monitor weather conditions and manage appropriate response
- Facilitate freight mobility via deployment or support of commercial vehicle operations (CVO) related systems such as traveler information, safety, permitting and credentialing, weigh-in-motion, etc.
- Coordinate communications and information to support security measures statewide
- Provide motorists and the media information on traffic and roadway conditions
- Conduct and/or coordinate internal operational activities such as lane closures for construction and maintenance activities, planning detours, and traffic management for special events
- Coordinate operational activities with transportation and public safety partners

4.2 Regional TMCs

The 11 NYSDOT Regions in New York State have historically operated with a great deal of independence in order to best meet the unique needs of each region. NYSDOT has defined three levels of TMCs:

Level 1 TMCs - are smaller, with limited transportation management field infrastructure. They focus on coordination of daily operations activities and management of special events and weather situations.

Level 2 TMCs - are usually mid-sized, with moderate transportation management field infrastructure. This field infrastructure usually focuses on critical corridors or smaller networks, but transportation management and operations extend to a much broader base. Extensive daily real-time traffic and weather condition monitoring, management, and coordination is performed.

Level 3 TMCs - are generally larger facilities with an extensive transportation management field infrastructure that perform a complex variety of tasks related to monitoring and managing the transportation network. This field infrastructure is deployed on a regional network-wide basis. Extensive daily real-time traffic and weather condition monitoring, management and coordination is performed.

These regional differences are fundamentally based on the differences in population density and the related traffic, as well as the type and number of state road miles in the region. Another important factor contributing to the difference in regional operations is the original DOT strategic decision to allow a great deal of autonomy, and the FHWA's encouragement of a regional focus for TMCs. The length of time in operation, related extent of systems development, and level of integration with partners are all important differences among regions.

Regional differences and autonomy have led to the implementation of a number of different systems across the state. These differences result in higher support costs and present hurdles to the consolidation

of information and the potential for inter-region support. The tables on the following pages provide information about the software systems and field hardware in use in the TMCs and the STICC.

Key Legacy Systems Used by TMC's - May, 2008

System	Primary Purpose	Developer (in-house or Vendor/System)	Key users / System Experts	Frequency of Use
ATMS				
ATMS	<p>ATMS generally perform the following functions (not all ATMS perform all functions):</p> <p>Controls ITS field devices (CCTV, HAR, Ramp meters, etc.), logs and tracks incidents, provides GUI for data input and data representation (speeds, incident locations, etc.), collects processes and archives detector data, drives TMC video system and video wall, support inventory and maintenance repair functions, etc.</p>	Region 1: Telvent/MIST	TMC Operators	Daily
		Region 2: None – uses vendor proprietary software for device control and data collection	TMC Operators	Daily
		Region 3: None – uses vendor proprietary software (including CHAMELEON) for device control and data collection	TMC Operators	Daily
		Region 4: Telvent/MIST	TMC Operators	Daily
		Region 5: IBI/Crossroads	TMC Operators	Daily
		Region 6: None – uses vendor proprietary (including HIGHWAY VIEW) software for device control and data collection	TMC Operators	Daily
		Region 8: Northrup Grumman/ TransCommander	TMC Operators	Daily
		Region 9: None – uses vendor proprietary software for device control and data collection	TMC Operators	Daily
		Region 10: CoVal for Southern Corridor; TransCore for Northern Corridor	TMC Operators	Daily
		Region 11: E&K and TransCore/SMARTS	TMC Operators	Daily

System	Primary Purpose	Developer (in-house or Vendor/System)	Key users / System Experts	Frequency of Use
Other Systems Used Routinely in TMCs				
CARS	Traveler info and internal tracking of events and closures	Castle Rock Consultants	All TMCs, Residencies	Daily
IIMS	Incident management data collection	General Dynamics	Region 11, JTOC	Daily
Transcom RA (to be replaced by OpenReach)	Tri-state incident database	Telvent Farradyne (OpenReach to be implemented by CoVal)	Downstate Regions, STICC (TRANSCOM)	Daily
TransAlerts	Subscriber-based Email/SMS notification system	NY-Alert	All TMCs, STICC	Daily
Other Systems Used Occasionally by TMCs or Supporting General Emergency or other Operations Reporting				
CARS Reports	Tracking deployment of staff and equipment during emergencies	Castle Rock Consultants	All Regions	As needed
EARL (baby)	Daily log of incidents and actions in the STICC (MS Access)	In house	STICC STICC operators	Daily by STICC
ETIPs	“Free Form” application to allow special event or emergency information to be posted on the DOT website	In house	All Regions, STICC	Occasionally for major special events or emergencies
Fleet Anywhere	Primary database tool for the management of DOT fleet vehicles	Maximus	All Regions, MO OFA	Daily by Fleet Management

System	Primary Purpose	Developer (in-house or Vendor/System)	Key users / System Experts	Frequency of Use
RSDA	Used for documenting initial damage and roadway status during emergencies	In house	All Regions STICC	Only during emergencies
WTA	Traveler Info for winter weather related road conditions	In house	All Regions, STICC	During winter months – primarily by Maintenance
MAMIS	Used for managing daily work assignments, accomplishments and financials for Maintenance personnel	Booz Allen	All Residencies, Regions	Daily by Maintenance
DisasterLAN	Used by SEMO to manage tasks and reporting to various state agencies. DOT monitors and updates as needed in response to SECC requests.	BCG	STICC, REMs	Only during emergencies

NYSDOT - Traffic Management Systems Deployment Summary by Region

Deployment Measure	NYSDOT REGION											Total
	1	2	3	4	5	6	7	8	9	10	11	
Freeway center-line miles under traffic management	60	0	32	50	23 Add Other NITTEC Members	6	0	121	0	260	130	682
Signals	597	319	436	678	890	178	162	1208	268	1119		5855
Centrally Controlled Signals	81	30	183	19	15	8	36	41	24	792	NA	1229
Directional miles under HELP Program patrol	160	0	0	104	40	0	0	802	0	258	55	1,419
TMC in operation	yes	yes	yes	yes	yes	yes	no	yes	Yes	yes	yes	
****Variable Message Signs	68	0	38 (14+24)	14	8 19 Other NITTEC Members	21 (2+19)	3	25	32 (11+21)	185	92	486
CCTV traffic cameras	30	0	26	45	41 55 Other NITTEC Members	37	10 (most not working)	18	5	192	238	642
Highway Advisory Radio stations	4*	0	0	2	0 14 Other NITTEC Members flashing signs	0	0	0	4	6	11	27
Ramp meters	0	0	0	0	0	0	0	0	0	91	9	100
Freeway Detector stations	27	23	14	30	20	0	0	30	0	860	956	1,960

Deployment Measure	NYSDOT REGION											Total
	1	2	3	4	5	6	7	8	9	10	11	
**Traffic Condition Warning Signs					10 1 Other NITTEC Members		4					14
Primary Field Communications D= Dial Up, L= Leased, F= Fiber, M= Microwave	L, F, D	D	M, D	L, D, F	F	D, M	D	L, D, F	D	F	L, F	

* Two (HAR) are portable Units, two are permanent stations.

** Traffic Condition Warning Signs include “Skyway Closing,” flashing beacons, and queue detection.

*** NITTEC chose to add these rows – other regions have Transmit, likely indicated in the section for “Freeway Detector Stations.”

**** Some regions chose to differentiate between permanent VMS and portable VMS.

5. USER-ORIENTED OPERATIONAL DESCRIPTION

5.1 Stakeholders

The stakeholders affected by this project include the following:

- NYSDOT Regional TMC management and staff who have primary responsibility for traffic management activities supported by ATMS/ATIS systems
- NYSDOT's Office of Traffic Safety and Mobility and the STICC - the groups responsible for policy direction and support for the regional TMCs
- Other NYSDOT operating units that depend on the TMCs for coordination of activities, for example:
 - Construction and Maintenance
 - Traffic Engineering
 - HELP operators
- NYSDOT departments that support TMC activities:
 - ITD
- Partner agencies who share information with the TMCs:
 - NY State Thruway Authority
 - NY State Police
 - TRANSCOM
 - Many other state and local public safety and public works agencies
- The traveling public who depend on the TMCs for information

5.2 TMC Organization

There are a number of different organizational models operating in the NYSDOT regions. The smallest regions (Level 1), are staffed completely with NYSDOT employees. In Region 2, these employees have primary responsibilities other than TMC related responsibilities. Other regions use a mix of state employees in management roles and contractors for technical support, supervisors, and operators. Most NYSDOT TMCs operate 24 hours per day. One exception is Region 2, which is covered off hours by Region 9.

Actual job titles vary, but each Regional TMC has "front line" operators who have responsibilities such as monitoring the various systems, operating field equipment such as signs and cameras, communicating with partner agencies, and entering data into travel information systems. All regions have a TMC manager and may have supervisors reporting to the manager. Larger regions also have technical managers and staff to support the ITS systems who may be either DOT employees or contractors. With outsourced operators, the contractor will usually have an on-site manager or supervisor.

Region 5 has joined with regional partners and outsourced the day to day TMC operations to a consortium staffed and managed by contractors. Region 11 has also formed a partnership with regional partners and operates their TMC with a combination of government employees and contractor staff. Regions 1 and 8 are co-located with State Police call centers, which allows for simple face-to-face exchanges of information.

More information on TMC activities is included in Section 4 above and Section 7 below.

6. OPERATIONAL NEEDS

A statewide ATM/ATIS platform must support at least those functions common to the majority of TMCs. A modular package would be ideal: one that could provide functional modules that support all possible TMC functions. The modules could be purchased and deployed in regions as needed.

6.1 Common TMC activities

There are a number of common activities that the majority of TMCs perform:

- Control of and data collection from field equipment:
 - Cameras
 - VMS
 - Traffic Signals
 - Roadway traffic and weather sensors
- Report traffic, road conditions, construction and maintenance incidents, and accidents and other travel information:
 - To the public, primarily through New York's 511 phone and web systems
 - To internal and external partners through email or direct data feeds
- Traffic management and coordination:
 - For regional roadway construction and maintenance (although in Region 5, this is done in DOT TOC)
 - Incidents, accidents, emergencies, and planned events
- Call center type activities:
 - Off hour call handling for DOT
 - HELP Truck Dispatch
- Activity logging and performance management
- Asset management

6.2 Base Level ATMS/ATIS Functions for a Statewide System

In order to support common TMC activities, a statewide ATMS must support the following minimum functionality:

6.2.1 Control of field equipment

Most regions have at least some video cameras and message signs. Traffic signals are handled differently in each region. Most regions have at least some roadway sensors. Because of the diversity of manufacturers and models, and the lack of standard protocol support on older equipment, the cost of integration of field equipment will need to be considered.

6.2.2 Incident recording and notification

All regions are required to feed information into the statewide 511 system. Upstate regions primarily use CARs, while downstate regions use TRANSCOM RA. Based on NYSTEC's interviews with regional TMC staff, the single most common requirement for any application is to reduce or eliminate the need for duplicate entry of activity-related information. Most of the current duplicate entry issues revolve around incident notification to internal and external partners and to the public. Some incidents require duplicate

entries into as many as five different systems. This need points to the importance of standardized incident entry processes and systems.

Related to the duplicate entry issue are incident management reporting and performance measurement. Most regions have created unique, local MS Access incident and activity logs to support customized reporting needs for TMC management that are not met by other ATMS or ATIS.

6.2.3 Traffic management and coordination

All regional TMCs provide some level of traffic management and coordination for construction and maintenance projects, incidents and events. This is especially important when the activities result in lane closures. Besides information recording and reporting discussed above, these activities also require command and control of field equipment, especially cameras and signs.

6.2.4 Integration with Partner Systems

In addition to internal NYSDOT needs, regional TMC strategy requires integration with regional partner systems; in particular, 911 Computer Aided Dispatch (CAD) systems. Some regions have already created some level of intersystem data sharing (e.g., Region 8 feeds from NYSP CAD). Several regions have committed to greater integration with regional partners in their Regional ITS Architecture documents submitted to FWHA.

7. SYSTEM OVERVIEW

7.1 ATMS/ATIS Functions

The following are potential features and functionality of ATMS/ATIS systems that will support the activities of TMCs (consolidated delivery of traveler information to the public, e.g. 511 phone and web systems are not considered in this list):

- Command and Control of field equipment
 - Camera control and viewing
 - Fixed – viewing only
 - PTZ – viewing and control
 - VMS management create messages, view and report status
 - Fixed
 - Portable
 - Roadway sensor data collection
 - Traffic sensors (loop detectors, acoustic, radar, and video, etc.)
 - Weather sensors
 - Other
 - Traffic Signal monitoring and operations¹
 - Highway Advisory Radio (HAR)
- Incident logging, tracking, and reporting (unplanned)
 - Accidents
 - Incidents
 - Weather observations – WTA data?

¹ Currently handled by central NYSDOT server (Streetwise)

- HAR
- NYSDOT construction and maintenance activities - logging, planning, coordinating, and reporting
 - Highway Maintenance Logging
 - Roadwork Logging
 - Signal Malfunction Logging
 - Road Closure Approvals
 - Highway Work Permits
 - OS/OW Permitting and Routing
 - Detour Routing
- Planned events logging, planning, coordinating, and reporting
 - Informational alerts; e.g., HOV rules
- Multi-Modal Needs
 - Data exchange with Transit
- External system data feeds
 - 511 systems
 - Regional partner CAD
 - EZ-Pass Transmit
 - TRANSALERT/NYALERT
- Alerting on various activity categories - internal, partners, media
 - Automatic
 - Manual
 - Email, phone, pager
- Traffic analysis and reporting (customizable)
- TMC activity logging, reporting, performance analysis
 - Communications log
- Vehicle and staff dispatch and related tracking and reporting
 - HELP Trucks
 - Towing program
 - ITS equipment repair (VMS, camera, signals, sensors, etc)²
- Emergency Transportation Operations (ETO)
- Map based views of construction and maintenance projects, equipment status, incidents, accidents, road and traffic conditions, travel time (map front end for data and reports)
- Map based asset tracking database³
 - DOT and Partner staff contact information
 - Hardware asset inventories (e.g., VMS, CCTV traffic signals)
 - Manual entry
 - GPS located
 - Vehicle tracking

² Expected to be handled by central NYSDOT server (Cartegraph)

³ Expected to be handled by central NYSDOT server (Cartegraph)

- Automated logic functions (response plans) in a number of areas based on data input from field hardware (traffic or weather sensors for example) or manual incident entry criteria, for example:
 - Automated alerts to operating partners
 - Automated deployment of traffic signal plans or VMS messages

8. OPERATIONAL ENVIRONMENT

8.1 Distributed Model – Three Levels

NYSDOT envisions a distributed deployment model that supports the different needs of regional TMCs, based on the level of complexity of operations and proximity to other TMCs. Implementation of the statewide standard system will be phased, based on regional need and existing contract expiration. The close contractual and operational integration with regional partners in Regions 5 and 11 TMCs will make the adoption of the proposed new systems more difficult.

Existing TMC activities, personnel, and organizational structures will be maintained with the new ATMS system. Changes to procedural details will be documented depending on regional needs and cross-regional support agreements. It is expected that as regions adopt the new systems, standardization of policies and procedures across regions will be encouraged.

The ATMS system will be deployed in existing physical space and on existing servers where possible. Some purchases of server hardware will be required. Level 3 TMCs, the largest and most complex, will house the ATMS/ATIS application servers and associated databases, as well as command and control software for local field equipment. These TMCs will act as a host site for smaller regions nearby. Level 3 regions may act as backup sites for each other, for operations and data storage.

The smallest regions (Level 1) with the least field equipment may choose to connect over a single Internet-based VPN tunnel and may only require local device control related servers.

Midsize regions (Level 2) will require a redundant connection to the serving Level 3 TMC; for example, by using an Internet VPN and a circuit provisioned over the NYeNet if available. These regions will also likely require local database servers and local device command and control servers.

The drawings below illustrate the distributed deployment concept and proposed connectivity.

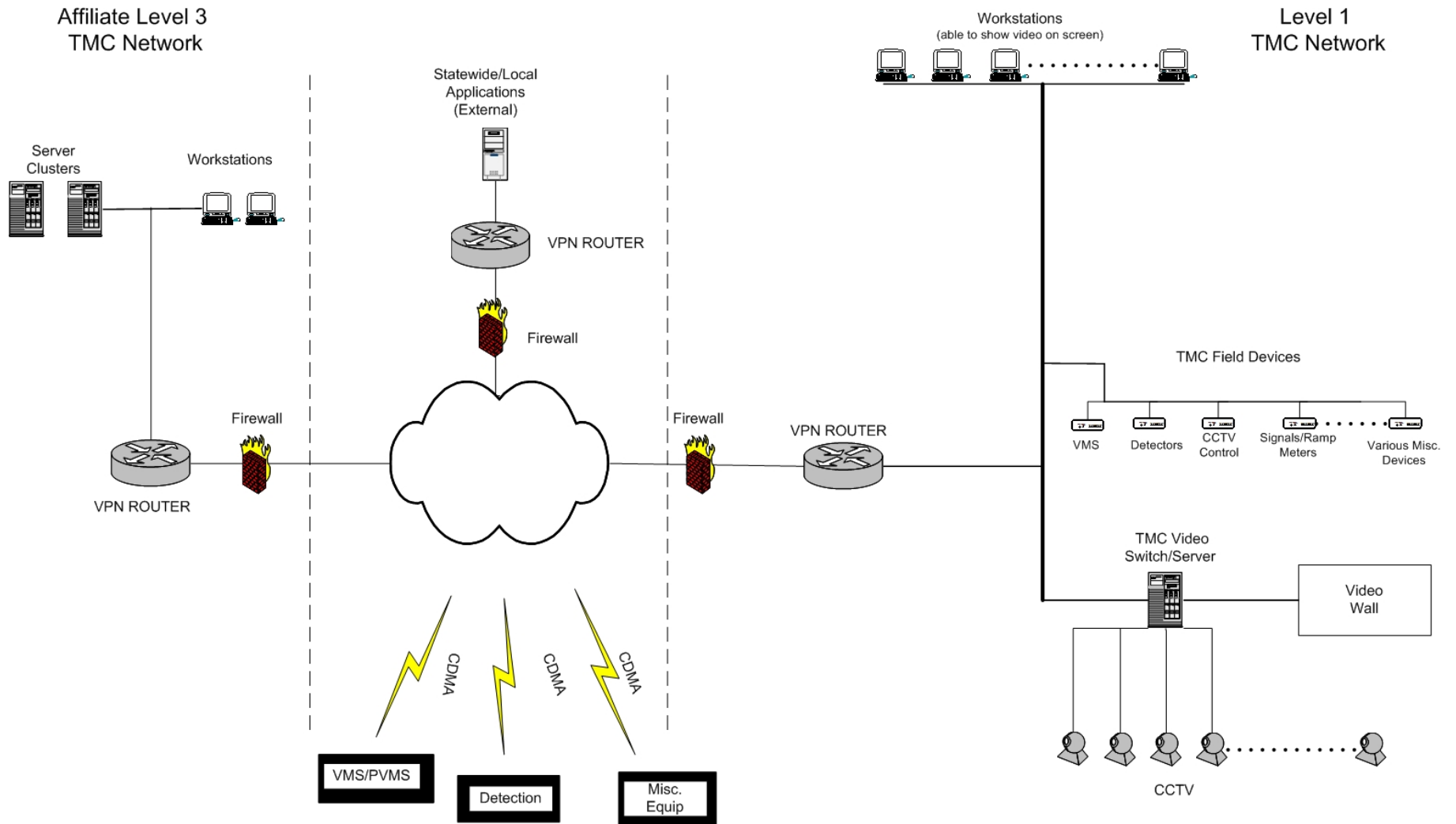


Figure 1 ATMS Deployment - Level 1 to Level 3

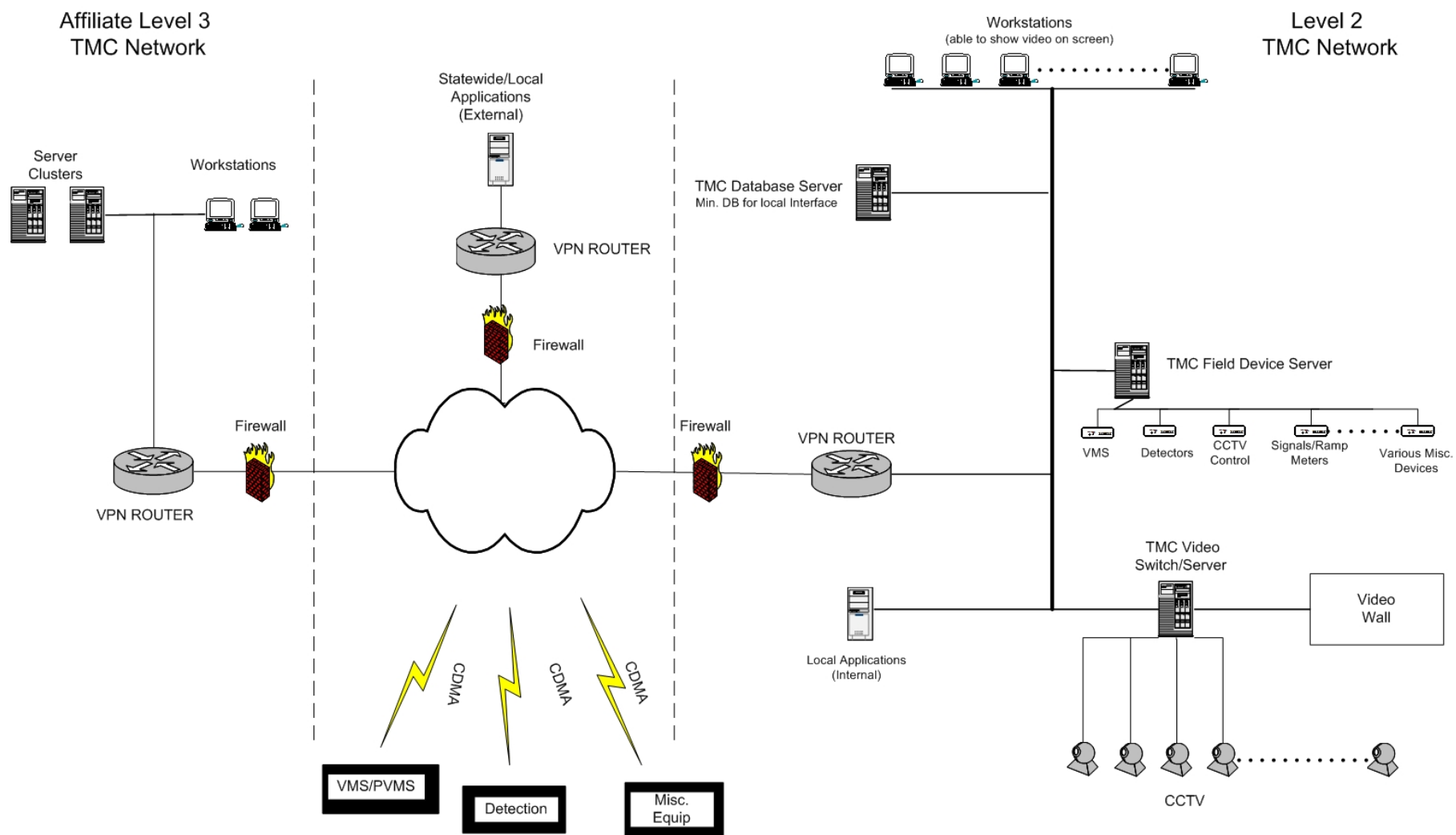


Figure 2 ATMS Deployment - Level 2 to Level 3

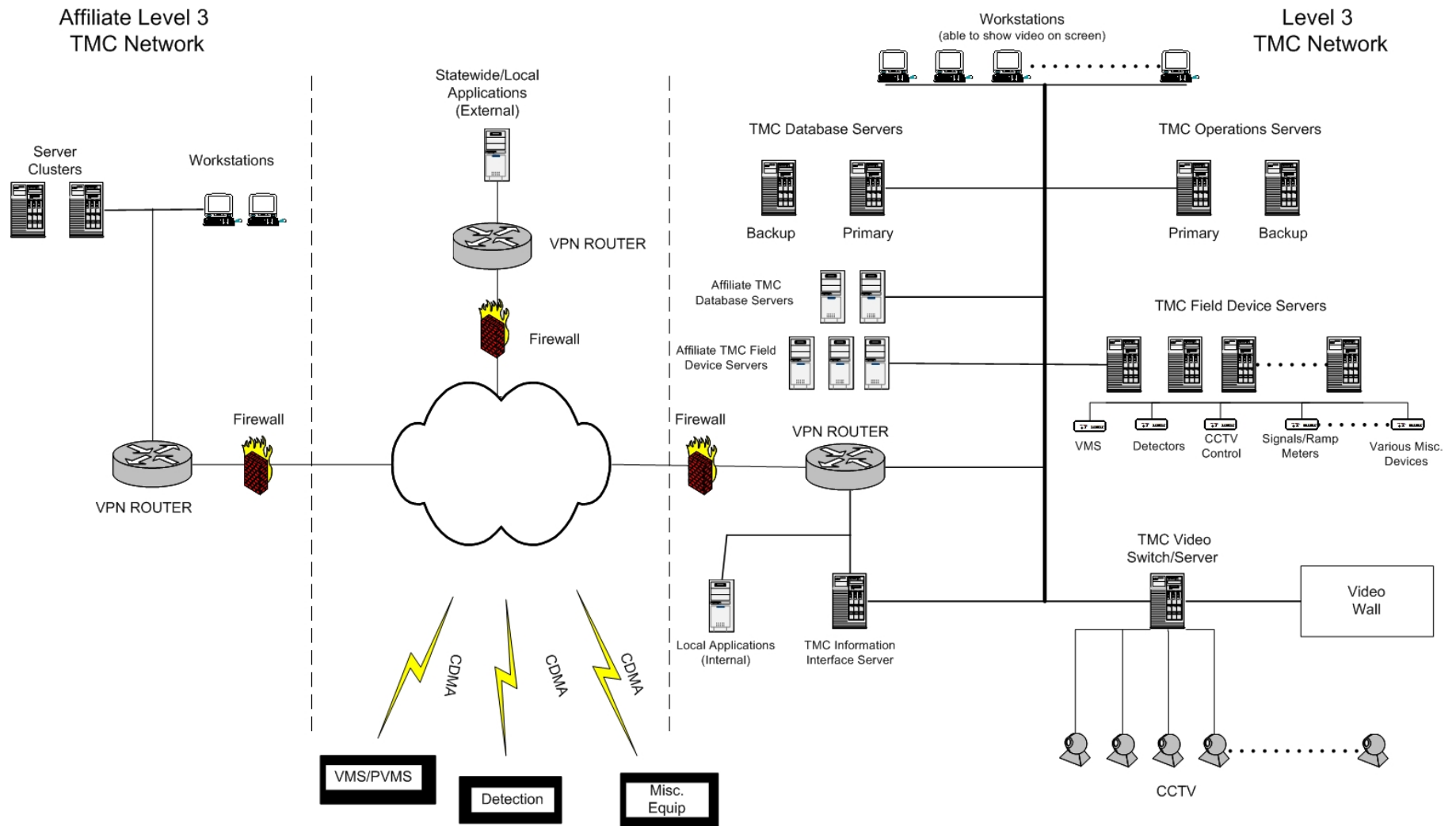


Figure 3 ATMS Deployment – Level 3 to Level 3

8.2 Network model

The current practice of maintaining separate ATMS and business networks should be continued, especially for critical control operations for cameras, signals, ramp meters and VMS. As stated above, it is expected that redundant connections will be required between regions in most cases. One connection could be over a secure Internet based VPN site to site tunnel using IPSec or MPLS. The other connection could be made over the NYeNet or through a vendor provided private line. Access to the business network could be through a firewalled connection.

A number of important issues must be considered when sizing the network connections between regions including:

- The latency requirements of field equipment and associated command and control applications
- The bandwidth requirements of video streaming

This second consideration may be the biggest limitation to full site backup between large regions. The cost of streaming multiple simultaneous high resolution video feeds to a remote backup site must be taken into account. A remote region would be capable of controlling and viewing individual, or a small number of cameras at one time, which may be all that is necessary.

The cost of provisioning redundant network connections from individual pieces of field equipment, such as a camera or VMS to a backup site, makes it likely that a single point of failure will exist in the data center of each regional TMC. The exception to this scenario is when field equipment is connected over a carrier's cloud, either wired or wireless. As an example, VMS connected through Verizon's cellular network could be rerouted by Verizon to a TMC backup site with prior arrangement with the carrier. There may additional costs involved for secondary VPN tunnels.

In the case of private networks, such as those in use in Regions 10 and 11, interconnectivity with routing ability could be provisioned outside of the TMCs at another state office site or on a carrier's network.

9. SUPPORT ENVIRONMENT

9.1 Current Physical Support Environment

9.1.1 Systems and Software Support

The existing physical support environment is not consistent across the state. The NYS DOT's Information Technology Division (ITD) is configured to provide technology support for traditional business applications and the NYS DOT's business network. In general, ITD does not support the physical equipment associated with the TMC. Under the current model, ITD does not have the capacity or expertise to sufficiently manage the architecture of an ATMS network in the Regional TMCs. The complexity of the numerous network and communication system configurations in the different centers presents additional stumbling blocks to ITD's traditional support role.

This has resulted in varying support models in the Regions. Smaller TMCs with less complicated systems rely heavily on in-house personnel who have varying amounts of formal training in the IT field. This has proven relatively successful to date, although this success has become critically dependent upon one or two people within a Region.

Mid-sized TMCs rely on a combination of contracted expertise and in-house personnel. Typically, in-house personnel manage and maintain the systems and equipment they are most familiar with and utilize the consultants to handle all other systems.

There is a high level of risk associated with both of the above models as TMC systems become more complex and as both the NYS DOT and travelers become more dependent on the reliability of those systems. Current budget constraints do not provide for the ability to assign qualified IT technicians from within the agency to TMC's. Maintaining these systems utilizing one or two specific individuals, who have developed unique expertise on the systems, cannot be sustained indefinitely.

Due to the complexity and physical size of their infrastructure, larger TMCs contract-out the support and maintenance of all of their TMC systems and field equipment. This has proven successful, as the contracts provide the ability to specify needed expertise in each area. This model, however, can be very costly to a Region, consuming scarce capital funds. In addition, the contract management oversight requirements associated with these types of contracts can be very demanding on the few NYS DOT people assigned to manage the TMC. Contract lengths are also limited, requiring a new bid every few years, which could result in a change of contractors. This means the new personnel who will be working on the systems will incur a learning curve during the transition, putting the system at risk for a period of time. In addition, this type of turnover puts additional demands on the TMC management personnel.

9.1.2 Personnel

The TMC staffing models vary across the state. Smaller TMCs are staffed using state personnel who are mis-assigned from other job titles, including TMC Operators, as well as the TMC management staff. This has resulted in some inconsistencies in staffing levels and personnel titles, not only from Region to Region, but within individual TMCs as well. The risk associated with using mis-assigned personnel can be high. If hiring constraints remain in place, it is anticipated that other areas of the NYS DOT will need to utilize TMC personnel to fill critical positions within their respective areas. TMCs have found it difficult, at times, to find personnel willing to move from traditional day shifts to TMC shifts, which may include some nights and weekends. This is especially true where there is no incentive, such as additional compensation. In response to these issues, the DOT has an ongoing effort with the NYS DOT of Civil Service to formalize job titles within the TMCs, providing for greater consistency, a well-trained pool of operators, and a clearly defined career ladder. This has been a multi-year effort that has seen some progress but has recently stalled due to budgetary constraints.

Larger TMCs rely heavily on consultants to staff their TMC operations. This model provides for greater flexibility with the operations staff. Some of the advantages of using consultants for this purpose are that it offers the TMC manager the ability to add operators during the busiest times and to scale back operations during less busy times. In addition, the contractor is solely responsible for ensuring that all shifts are adequately staffed, including covering sick and vacation leaves. A disadvantage to this model is its cost. A region that relies solely on contracted support to operate and maintain their TMC is going to incur significant recurring costs. This money is typically drawn from other sources, resulting in a reduction of funds available for other work. Managing a consultant contract comes with additional contract management duties, which can be time consuming, given that TMC managers are typically not engaged in that process on a full-time basis.

9.2 Future Physical Support Environment

9.2.1 Systems and Software Support

Level 3 TMC Support

Due to the complexity of the varied IT systems within the TMCs, the most practical approach to supporting these systems will be a hybrid approach. It is anticipated that large TMCs (Level 3) will be fully capable of supporting all TMC systems utilizing contracted personnel. The expertise available through the consultant contracts will allow the TMCs to operate with minimal assistance from the NYS DOT's overtaxed Information Technology group. Having the ability to utilize the consultant contracts

will provide the TMC with application-specific expertise and personnel who will be able to focus on the unique TMC systems exclusively. NYS DOT IT personnel, who are trained to operate and maintain traditional business-related applications, will continue to be utilized to maintain the NYS DOT's business network and systems within a TMC.

Level 2 TMC Support

Level 2 TMC's typically have consultant contracts available within their Regions to support their systems. Contractor support at the Level 2 TMCs is generally adequate to support all of their current systems, although they may have limited capacity to support additional, more complex systems. It is envisioned that in some cases, it will be in the best interest of the NYS DOT to have additional support available from a Level 3 TMC for elements of the Level 2 TMC systems. This may include database support and system-specific support. Business systems and the NYS DOT's network structure will continue to be supported by ITD. A formal, documented relationship between the Level 2 and Level 3 TMCs will be established to make the most efficient use of the contracted system support personnel and to clearly outline the duties of each contractor, as well as ITD.

Level 1 TMC Support

Level 1 TMCs will not have consultant contracts available within their Regions. The proposed support model will include utilizing contractor support between a Level 3 TMC and a Level 1 TMC. Business systems and the NYS DOT's network structure will continue to be supported by ITD. The ITS exclusive network, and systems related to it, will generally be supported by the Level 3 TMC contractor. It is expected that the contractor will, from time to time, need to work closely with the NYS DOT's IT personnel to troubleshoot and resolve problems. A formal, documented relationship between the Level 1 and Level 3 TMCs will be established to make the most efficient use of the contracted system support personnel. This support outline will be unique from Region to Region, but will entail similar overriding principles. In addition, ITD will need to be able to commit to a standard level of support for these non-traditional systems within Level 1 TMCs. Included within that support agreement must be an acknowledgement of the real-time environment of the TMC Operations and the potential for after-hours response in limited situations.

Information Technology Division

ITD will be responsible for setting policy with respect to ITD standards, practices, and security for all TMCs. Level 3 contractors must structure their support in such a manner as to comply with the objectives of these policies. ITD will also be responsible for ensuring that the appropriate amount of support is available to all TMCs, through both physical assignment of Regional personnel and traditional HELP desk support.

Traffic Safety and Mobility

Traffic Safety and Mobility is responsible for providing direction to the Regions with respect to overall program direction, ATMS requirements, and general operations of the TMCs. Statewide consistency in the delivery of traveler information and support for system operations is the overriding principle that guides the direction to the Regions. The delivery of these elements in a more consistent manner will improve the efficiency of the overall operations of the NYS DOT and will have a positive impact on reducing congestion in the system.

10. OPERATIONAL SCENARIOS

This Section includes a number of scenarios that describes a sequence of events, activities carried out by the user, the system, and the environment. The scenarios cover normal conditions, stress conditions, and failure events. It provides a means for critical stakeholders to see what their expected role is. The scenarios are representative and described at a relatively high level. They are not meant to describe every possibility or action, but collectively involve the significant Users from Section 7 and Operational Needs for Section 8 of this report. Users, stakeholders, and activities in the scenarios overlap. Accordingly, each scenario focuses on the elements critical to the specific circumstances but does not repeat basic activities. In particular, the activities in Scenario #1 – Recurrent Congestion, discuss a foundation of users, stakeholders, and actions that are largely common to all Scenarios. Accordingly, subsequent scenarios build on major differences in operations under the specific scenario conditions and largely do not repeat the foundation activities.

10.1 Operational Scenario #1: Daily Operations - Recurrent Congestion (no incidents)

Typical TMC

- Monitor the condition and performance of the transportation network, including freeways, arterials, HOV/special purpose lanes, border crossings, and the operational status of the other modes (exception basis). Monitoring is facilitated by use of an integrated ATMS that provides user friendly access to viewing:
 - CCTV cameras
 - Speed/flow/travel time information provided by detectors
 - Central controlled/closed loop traffic signals
 - VMS and HAR status
 - Integrated real-time conditions reporting and information for internal use (with functionality as presently provided separately by CARS, RA, WTA and RWIS)
 - 511 (integrated real-time conditions reporting and information system for external users)
- Monitoring also involves:
 - Real-time reports from operational stakeholders such as police, fire, traffic signal crews, HELP patrols, construction and maintenance personnel, other NYSDOT Regions, and other transportation agencies, as well as the media and the public - could be via a variety of mechanisms, including telephone and email
 - Television and radio news/traffic reports
 - The internet
- Enter data into the ATMS to provide for situational awareness, status tracking, and internal and external notifications to operational staff and partners. Data entry into the single integrated ATMS eliminates duplicate entries and automatically populates systems for statewide view as appropriate. These systems include:
 - TMC ATMS
 - CARS, RA, and WTA
 - Email
 - 511
 - TransAlert
- Key internal and external notification partners include:
 - Regional management, Regional Maintenance, Construction and Traffic & Safety, Other NYSDOT TMCs/regions, STICC/MO, State and Local Police, Other Agencies, Localities, Emergency Responders

- Manage traffic flows via operation of ITS systems and devices and other operational strategies and activities via the ATMS. These actions may be done manually or via automated processes. They include:
 - Adjust signal timing on arterials
 - Adjust ramp metering flow rates
 - Provide travel time information
 - Post messages on VMS and HAR

Management of traffic flows may also involve efforts such as coordination of work zone lane closures.
- Using the integrated ATMS, enter data and/or operate devices that provide traveler information to the public and media including:
 - 511 (CARS/RA)
 - TransAlerts
 - VMS/HAR
 - WTA
 - Travel time signs
 - Regional ITS web sites
- Receive and log calls related to operational problems into the integrated ATMS. Document calls received, actions taken, activities performed, and system condition. Make notifications and monitor response/resolution of calls as appropriate. Calls include those related to the following:
 - ITS and traffic signal malfunctions
 - Maintenance problems (dead animal, flooding, sign knockdown, etc.)
 - Duty Officer
 - Accident damage
- Monitor and manage the HELP motorist assist patrols via the ATMS. Maintain communications with drivers/trucks regarding duty status, stops, assistance provided, locations, conditions, response required, etc. Log data for records, analysis, performance measures, and archiving.
- Monitor the ongoing operational conditions of planned construction and maintenance projects and special events to assess and manage impact on transportation network operations. The ATMS will provide the mechanism to track related processes and status including:
 - Review, approve, and manage maintenance and construction lane closures in response to real time impacts
 - Coordinate VMS deployment and messaging
- Monitor the operational status of the management and information systems with respect to proper operating condition. In the event of failure or improper operations, failures are logged, and work orders are created, assigned and tracked to completion. TMCs coordinate with field maintenance personnel as needed during scheduled and emergency repair, to confirm work has been accomplished and, if applicable, equipment has been returned to proper operations. The ATMS will provide functionality for monitoring device status, logging failures, managing repairs, and developing performance measures.
- Support other maintenance operations special activities as needed. The ATMS may provide support for this at a high level depending on the function, priority, and value added. These functions include:
 - Snow and ice dispatch
 - Weather watch
 - Monitoring environmental or weather advisories and/or systems (e.g., RWIS)

Other NYSDOT TMCs

- Perform local TMC operations as identified for *Typical TMC*. The ATMS provides a common statewide tool for this.
- Monitor systems for situational awareness of conditions in other Regions/areas that might require coordination and/or response. The center-to-center communications and network architecture of the ATMS provides STICC, all Regional TMCs, and key internal and external stakeholders, access to the system information and/or functionality depending on their need.

STICC

- Monitor systems for situational awareness of statewide conditions that might require coordination and/or response. Easy and effective monitoring is provided via the statewide ATMS, which provides user friendly access to the same capabilities as for TMCs. Monitoring also involves:
 - Real-time reports from operational stakeholders such as police, fire, traffic signal crews, HELP patrols, construction and maintenance personnel, other NYSDOT Regions, and other transportation agencies, as well as the media and the public - could be via a variety of mechanisms, including telephone and email
 - Television and radio news/traffic reports
 - The Internet
- Coordinate with SEMO as needed to support their situational awareness needs. Enter data into the ATMS to provide for situational awareness and tracking, and internal and external notifications to operational staff and partners as appropriate to STICC's statewide function (including functionality as currently provided by EARL).
- Receive and log calls related to operational problems as appropriate to STICC. Document calls received, actions taken, activities performed, and system condition. Make notifications and monitor response/resolution of calls as appropriate. The ATMS will provide for this functionality.
- Monitor the operational status of STICC management and information systems with respect to proper operating condition. In the event of failure or improper operations, failures are logged, and work orders are created, assigned, and tracked to completion. TMCs coordinate with field maintenance personnel as needed during scheduled and emergency repair, to confirm work has been accomplished and, if applicable, equipment has been returned to proper operations.
- Produce statewide performance measures using regional and STICC data per functionality provided by the ATMS.
- Support other operational functions including:
 - Rail inspector dispatch

10.2 Operational Scenario #2: Major Freeway Incident – Local Response (involving one Region)

Typical TMC

- **Detection:** While monitoring transportation conditions, the TMC receives a report by telephone from the local police that an incident has occurred on the freeway. The TMC operator obtains the information initially available, including facility, direction, location, lanes blocked, injuries, response “to date,” vehicles involved, additional response needed, etc. Incidents may also be detected in a variety of other means, including visually via CCTV or speed map, television or radio reports, etc. Since the incident is reported by a trusted source, and if sufficient information is available initially, the incident is logged into the ATMS and the remaining incident management activities are initiated.
- **Verification:** The operator uses monitoring tools at the TMC to verify elements of the incident report such as the location, traffic impact, responders on scene, etc. If the reporting source was

trusted, this provides additional verification, as well as an operational status update. If the initial source was not trusted, this provides verification, and the incident is then logged and the remaining incident management activities are initiated.

- **Notifications/Response:** Using standard operational protocols, the operator notifies internal and external stakeholders of the incident, incident details, status, and any response activities requested. The ATMS supports this through tools such as group email lists, incident reporting templates, etc. As needed, the operator initiates response activities, including internal resources. This may include notification/dispatch of HELP vehicles, requests to Maintenance for MPT, or other support such as sand, roadway clean up, etc. The operator may also need to contact other internal programs if there is a spill, structure damage, etc.
- **Monitoring/Coordination:** As the incident unfolds, the operator monitors it, assesses impact on traffic, provides additional support, and updates notifications. Close coordination is maintained with enforcement and with any internal resources on the scene to maintain a good awareness of status and developing needs. Other responders may need to be called to the scene including towing, DEC, coroner, etc. While these calls are often made by enforcement, the operator supports this activity as needed.
- **Traffic Management/Traveler information:** The operator assesses the impact of the incident on the facility and traffic and considers probable duration. Based on this, he begins to use the ATMS to implement traffic management strategies. This may include changing signal timing if nearby arterials are affected, adjusting ramp meters to reduce demand, activating messages on VMS and HAR warning motorists of delays or advising of lane closures or alternate routes, updating travel times in the affected area, etc. In some circumstances, such as VMS and travel time, the ATMS will automatically begin posting messages and changing travel times based on a pre-programmed response of real-time data. The operator will monitor these actions and update or override them as may be necessary. For incidents of sufficient duration, the operator will examine construction and maintenance operations in the area and adjust lane closures or work operation location and time as appropriate. Based on entry of a verified event into the ATMS, the event will be posted to traveler information systems such as 511 and TransAlert, without the need for duplicate entry. Automatic notification and details will be provided to STICC. The media will also be kept apprised of the status via notification processes.
- **Clearance/Recovery:** The operator will monitor the incident through its life cycle and update status and notifications, coordinate support, adjust traffic management strategies as appropriate, and update traveler information. Much of this activity is supported by the ATMS monitoring, control and logging/notification features. As responders leave the scene and traffic conditions begin to recover to normal, traffic management strategies will be revised back toward normal, and traveler information will be updated to advise that the incident is cleared.
- **Post incident:** The operator will close the incident in the ATMS log and ensure that systems have been returned to normal. Any need for follow-up response or coordination will be logged/initiated (e.g., guiderail repair). Any need for a post incident assessment will be noted.

Other NYSDOT TMCs

- Will continue to perform local TMC operations as identified for *Typical TMC*. The ATMS provides a common statewide tool for this.
- Will be advised/aware of the incident via the center-to-center communications systems. Regions with closer proximity and impact may have an alarm generated. These Regions will monitor the status of the incident in the event the impact escalates and affects them and/or they are needed to provide response support.

STICC

- If the incident meets STICC reporting criteria, they will be alerted to the incident via the ATMS notification capabilities. Depending on the nature of the incident, STICC may receive an alarm.
- STICC will log the incident into the STICC reporting module of the ATMS and, if sufficient information is available, initiate the internal notification process. Depending on the nature of the incident and information available, STICC will follow up with the Region for additional details and initiate/update the notification as the information is available, or as the incident evolves.
- STICC will monitor the event for status changes and clearance, gathering appropriate information, updating notifications, and ultimately closing the event. Monitoring will be done via the system notifications, but STICC will also have access to the ATMS to monitor local CCTV, VMS, speed data, etc.
- Depending on the nature of the incident, STICC will make special notifications and/or call out specialized support (e.g., bus or rail inspectors, SEMO, etc.).

10.3 Other Scenarios

Major incidents involving multiple regions will follow the same general procedures, but the STICC will play a prominent role in coordinating activities between regions. Additional coordination by the region will be required for incidents that involve assets of partner agencies that require the assistance of NYSDOT to resolve (e.g., a train derailment that requires road closures and detours on state roads).

11. SUMMARY OF IMPACTS

11.1 NYSDOT Regional TMC Management and Staff

The primary stakeholders are NYSDOT Regional TMC management and staff who have responsibility for traffic management activities supported by ATMS/ATIS systems. Any change to these systems will have the greatest impact on TMC operations staff. All regions (except regions in which the system is currently deployed) are likely to experience some level of disruption during the transition to the new system, although with careful planning this can be minimized. Training will be required on features and functions of the new software user interface. Policies and procedures must be written to cover new and changed functionality.

If the distributed model described in Section 9 is implemented, Large regions (Level 3) will have the added responsibility of supporting the systems of smaller regions (Levels 1 and 2), and backing up other Level 3 regions. Ideally, the smaller regions' ATMS will operate as an extension of the larger regions, but statewide operating standards must be developed to support this model. Level 2 regions may have a substantial amount of field equipment connected to the ATMS, but it is expected that responsibility for this equipment will remain with the region. Statewide standardization of field equipment will minimize the complexity of implementation and support.

All regions should benefit from the reduction in duplicate data entry requirements for activity and incident reporting. Smaller regions should experience an increased level of system features and sustainable ATMS support not dependent on the knowledge or expertise of one individual.

11.2 NYSDOT's Office of Traffic Safety and Mobility and the STICC

NYSDOT's Office of Traffic Safety and Mobility and the STICC are the groups responsible for policy direction and support for the regional TMCs. These groups will take on a new role in recommending statewide policies for ATMS deployment and operations. Statewide standards for field equipment and

network connectivity should be developed. Performance monitoring and measurement, once standardized, should become easier and largely automated.

The STICC should have increased visibility into the regional ATMS system and will have less need for requests for information from regional operators. STICC staff will require training on the new system but should have fewer different systems to work with.

11.3 NYSDOT Information Technology Division (ITD)

Currently, NYSDOT ITD provides minimal direct support for ATMS systems. Each regional TMC is responsible for operating and maintaining its own system, usually with a combination of state employees and contractor staff.

ITD could play a larger support role when a statewide standard system is implemented. ITD could, at a minimum, perform ATMS server and network monitoring without additional training or staff. With training, some level of application support could be provided. One potential hurdle is the issue of 24x7 support, or how off hour support will be handled.

11.4 Other NYSDOT Operating Units

Other operating units, such as Construction and Maintenance, and Traffic Engineering should not experience adverse affects from implementation of a new system. In regions where these units have direct input or viewing of ATMS data, training on the new system will be required.

There should be a positive impact on the amount of data that is available for these groups to use for analysis in construction, maintenance, and engineering projects, especially in regions that have sensors deployed but lack the systems to collect and interpret the data.

11.5 Partner Agencies

The impact of implementation of any new statewide system on partner agencies, such as the NY State Thruway Authority, NY State Police, and other state and local public safety and public works agencies, will vary greatly depending on the region. In smaller regions without direct ATMS data connections, these partners should see only the positive affect of more robust NYSDOT TMC operations.

For regions that have tightly integrated operations with partner agencies, such as Regions 5 and 11, impact will be significant, and implementation of a new system would require agreement of all parties. Implementation in these regions must be considered a long-term goal.

11.6 The Traveling Public

The traveling public should benefit from a statewide system by the availability of increased and consistent travel information. This should be especially noticeable in smaller regions where it will become possible to support new and a greater number of sensors. The standardization of processes and procedures that accompany a statewide system should lead to less driver confusion; for example, through uniform message standards for VMS.