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DISTRICT DEPARTMENT OF TRANSPORTATION
2000 14th Street, NW
Washington, DC 20009

CAPITAL TRAFFIC OPERATION PLATFORM (CAPTOP) PHASE 1: SOFTWARE FUNCTIONAL REQUIREMENTS DEVELOPMENT

(DC Contract # POKA-2006-T-0055-VH Task No. 7)

TASK 3: OPERATIONAL REQUIREMENTS

DISTRICT OF COLUMBIA
DISTRICT DEPARTMENT OF TRANSPORTATION

January 10, 2009

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10. Abstract

The objective of this report is to document the operational requirements for the CapTOP program. The development of operational requirements documented in this report involved the analysis of what the system needs to perform, when it needs to do it, and how well it needs to perform. These operational requirements describe the capabilities and functions to be performed in the CapTOP system, and are written from the user's perspective. This Operational Requirements Document (ORD) is used in conjunction with the Concept of Operations Document (ConOps) and the Functional Requirements Document (FRD) to provide a thorough understanding of the CapTOP system.

The operational requirements have been organized into five different categories: system-level, user, interface, objective and performance. Furthermore, requirements were identified for 25 operational areas that DDOT performs, including amber alert, incident management, special event planning and management, traffic operations and management.

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ACRONYMS

Abbreviation	Full Text
ANSI	American National Standards Institute
ATMIS	Advanced Traffic Management & Information System
ATMS	Advanced Traffic Management System
AVL	Automatic Vehicle Location
C2C	Center-to-Center
C2F	Center-to-Field
CAD	Computer-Aided Dispatch
CapTOP	Capital Traffic Operation Platform
CapWIN	Capital Wireless Integrated System
CASE	Computer-Aided Software Engineering
CATT	Center for Advanced Transportation Technology
CCTV	Closed-Circuit Television
CHART	Coordinated Highway Action Response Team
CIP	Critical Infrastructure Protection
CIPS	Critical Infrastructure Protection System
CVISN	Commercial Vehicle Information Systems and Networks
CO	Carbon Monoxide
ConOps	Concept of Operations
COTS	Commercial-Off-The-Shelf
DDOT	District Department of Transportation
DMS	Dynamic Message Sign

DOT	Department of Transportation
DPW	Department of Public Works
DVR	Digital Video Recorder
EMA	Emergency Management Agency
ESRI	Environmental Systems Research Institute
FRD	Functional Requirements Document
GIS	Geographic Information System
GUI	Graphical User Interface
HAR	Highway Advisory Radio
HSEMA	Homeland Security and Emergency Management Agency
IM	Incident Management
IPMA	Infrastructure Project Management Administration
ITS	Intelligent Transportation System
LAN	Local Area Network
MD	Maryland
MDOT	Maryland Department of Transportation
MPD	Metropolitan Police Department
MWCOG	Metropolitan Washington Council of Governments
NAWAS	National Warning System
NCR	National Capital Region
NOVA	Northern Virginia
NTCIP	National Transportation Communications for ITS Protocol
NVR	Network Video Recorder
ORD	Operational Requirements Document

PDMS	Portable Dynamic Message Sign
POC	Point of Contact
RICCS	Regional Incident Communications and Coordination System
RITIS	Regional Integrated Transportation Information System
ROC	Roadside Operations Computers
ROP	Roadway Operations Patrol
RTMS	Road Traffic Monitoring System
RWIS	Road Weather Information System
SCADA	Supervised Control and Data Acquisition
SDE	Spatial Database Engine
SHA	State Highway Administration
SOP	Standard Operating Procedure
SQL	Structured Query Language
TCP/IP	Transmission Control Protocol/Internet Protocol
TCP/UDP	Transmission Control Protocol/User Datagram Protocol
TIMS	Traffic Information Management System
TMC	Traffic Management Center
TSO	Transportation System Operator
UCC	Unified Communications Center
UMD	University of Maryland
VA	Virginia
VCR	Video Cassette Recorder
VIPS	Video Interoperability for Public Safety
VDOT	Virginia Department of Transportation

WAN	Wide Area Network
WASA	Water and Sewage Authority
WIM	Weigh in Motion
WMATA	Washington Metropolitan Area Transit Authority
XML	Extensible Markup Language

1. INTRODUCTION

The District Department of Transportation (DDOT) Traffic Management Center (TMC) plays a critical role in managing the traffic and mitigating the adverse impacts of incidents and special events on the District's transportation system. The new CapTOP system is the core of the Advanced Traffic Management System (ATMS). As envisioned by DDOT, CapTOP will evolve into a system to provide centralized management of traffic management activities, including management and operation of ITS devices, and traffic management for planned and unplanned incidents and events that impact transportation in the District. CapTOP will facilitate the exchange of transportation-related information across a variety of agencies within the region, and provide an integrated interface to a number of traffic-management related systems. DDOT commissioned the development of operational and functional requirements documents to form the basis for the detailed design and implementation of the CapTOP.

In previous tasks, an inventory and analysis of existing DDOT ITS systems and software were performed, stakeholder interviews were conducted, operational objectives and user needs were identified, and a Concept of Operations was developed. This task builds upon work conducted in previous tasks to develop operational requirements. The operational requirements describe the capabilities and functions to be performed in the CapTOP system, and are written from the user's perspective. The development of TMC operational requirements documented in this report involved the analysis of what, when, and how well the system needs to perform. The operational requirements support and are consistent with findings documented in Technical Memorandum 1: Document Review Findings *(ref 1)*, Technical Memorandum 2: Interview Findings and Stakeholders' Needs*(ref 2)*, and the Task 2 Report: Concept of Operations *(ref 3)*.

The operational requirements are categorized and structured in a tabular, hierarchical format in this document. A coding scheme is used to organize the requirements around operational areas. A Computer-Aided Software Engineering (CASE) tool was used to ensure traceability among operational requirements, user needs, and scenarios (i.e., use cases). In a future task, the functional requirements will be derived to satisfy these operational requirements.

1.1 Purpose

This Operational Requirements Document (ORD) is used in conjunction with the Concept of Operations (ConOps) document and the Functional Requirements Document (FRD) to provide a thorough understanding of the CapTOP system and to reduce the development effort by minimizing errors, omissions, misunderstandings, and inconsistencies. It will be revised periodically to reflect the expanding capabilities of the CapTOP system.

The purpose of the CapTOP system is to achieve the goals set forth in the CapTOP Concept of Operations document which support the DDOT mission of providing safe and efficient movement of people and goods in and around the District and providing a safe seamless transportation system.

As stated in the Concept of Operations document, the goals of CapTOP are:

- To assist in the timely response to incidents, special events, weather events, and emergencies, and to disseminate traffic information to the roadway users in real time so that they can make informed decisions;
- To reduce recurring traffic congestion, and resultant delay, emissions, and fuel consumption;
- To reduce traffic congestion caused by incidents.

These goals drive the following operational objectives for the CapTOP system:

- Provide an integrated operational framework to support all operational functions to enable reliable, accurate, and timely traffic management and traveler information;
- Provide a modular and flexible system architecture that can easily integrate with existing and new systems;
- Provide the capability for an integrated, dynamic, real-time, and proactive traffic management system to mitigate congestion and optimize traffic operations;
- Provide the capability to integrate traffic management across the entire District of Columbia and to provide tools to coordinate with neighboring jurisdictions;
- Support detection and rapid response to incidents and collaborative action to provide integrated responses;
- Provide information and functional capabilities to accommodate transportation management strategies;
- Accommodate the operational needs of all operational areas;
- Provide information management and communication capabilities to ensure the integrated operation of all ITS/ATMS elements;
- Support management functions to measure and maintain optimal system performance;
- Support management functions to measure and maintain TMC operators' operational performance.

These objectives are the basis for the operational requirements that will guide development of the functional requirements.

1.2 Scope

The development of TMC operational requirements documented in this report involved the analysis of what, when and how well the system needs to perform. The operational requirements in this document are derived mainly from the following three (3) documents:

- Technical Memorandum 1: Document Review Findings[*(ref 1)*];
- Technical Memorandum 2: Interview Findings and Stakeholders Needs[*(ref 2)*];
- Task 2 Report: Concept of Operations[*(ref 3)*].

A complete list of documents referenced is provided in Section 1.4.

The ORD covers the analysis of what CapTOP needs to perform and defines the system processes, performance, information flows, and constraints, which the CapTOP must incorporate and operationally satisfy.

1.3 Organization of Operational Requirements

The operational requirements are organized into categories grouping similar requirements together. These categories include system-level requirements, user requirements, interface requirements, objective requirements, and performance requirements as shown in TABLE 1 below.

TABLE 1 Operational Requirement Types

Requirement Type	Abbreviation	Description
System Requirement	SR	CapTOP system-level requirements
User Requirement	UR	CapTOP users' requirements
Interface Requirement	IR	CapTOP system and user interface requirements
Objective Requirement	OR	CapTOP objective requirements for operational functions
Performance Requirement	PR	CapTOP operational functions and subsystem requirements

To maintain a common structure and facilitate traceability, the operational requirements are presented in a tabular format with the following columns:

- **ID** – A unique identifier for each requirement. The identifier is an alpha-numeric pattern in the form of AA-BBBB-NN, where:
    - AA = a 2-character identifier to indicate the type of operational requirement;
    - BBBB = a no more than 4-character identifier to designate the operational area, or CapTOP user groups. TABLE 2 and TABLE 3 below provide a mapping between the identifiers and requirement sources;
    - NN = a number assigned to the requirement.

- **Description** – A concise description of the operational requirement.

- **Source** – A unique identifier that allows the source/originator of the requirement to be traced. The "Source" identifier traces back to a coded user need that is identified in Appendix A of the Concept of Operations document[(ref3)]. From the coded user need in the Concept of Operations document, the stakeholder group that originally requested the requirement can be determined. The stakeholder groups are identified in Appendix D of Technical Memorandum 2[(ref 2)]. Appendix D in Technical Memorandum 2 lists the original stakeholder needs, sorted by stakeholder group.

- **Priority** – A 1-digit number representing the relative priority of the requirement as defined in Appendix D of Technical Memorandum 2, where 1 = high, 2 = medium, and 3 = low.

TABLE 2 Operational Areas

Operational Areas	Code
Amber Alert	See IM
Asset Management	See DDM
Center to Center Communication	C2C
Center to Field/Field to Center Communication	C2F
Critical Infrastructure Protection	CIP
Construction and Maintenance Management	CMM
CVISN Integration	CVSN
Device Diagnostics and Maintenance	DDM
Device Operation and Control	DOC
Data Warehousing and Archiving	DWA
Emergency Management	EM
Graphic User Interfaces	GUI
Incident Management	IM
Multi-modal/Multi-agency Coordination and Communication	MMC
Performance Measurement	PM
Roadway Operations Patrol	ROP
Regional Traffic Management Coordination	RTC
Special Event Planning and Management	SEPM
Software Management and Maintenance	SMM
System Design and Functions	SYS
Traffic Data Collection and Analysis	TDCA
Traveler Information Dissemination	TID
Traffic Operations and Management	TOM
Traffic Signal Monitoring	SIG
Tunnel Operations and Control	TOPS
Weather Event Management	WEM

TABLE 3 User Groups

User Groups	Code
External User	EU
Maintenance Manager	MM
Maintenance Technician	MT
ROP Driver	RD
ROP Manager	RM
System Administrator	SA
TMC Manager	TM
TMC Operator	TO
Transportation Planner	TP
Traffic Engineer	TE

1.4 Referenced Documents

The following documents have been used as reference material in the preparation of this report:

1. CapTOP Phase 1: Software Functional Requirements Development Technical Memorandum 1: Document Review Findings, District Department of Transportation and Daniel Consultants, Inc., August 1, 2008.
2. CapTOP Phase 1: Software Functional Requirements Development Technical Memorandum 2: Interview Findings and Stakeholders' Needs, District Department of Transportation and Daniel Consultants, Inc., August 1, 2008.
3. CapTOP Phase 1: Software Functional Requirements Development Task 2: Concept of Operations, District Department of Transportation and Daniel Consultants, Inc., October 10, 2008.
4. ITS Mission Definition, Architecture Development Team, Research and Innovation Technology Administration (RITA), US Department of Transportation, May, 2007.
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6. DDOT ITS Program Review (PowerPoint Presentation), Transportation Operations Division, District Department of Transportation, October 27, 2007.
7. Capital Traffic Operation Platform User Manual, Transportation Operation Division of Traffic Services Administration, DDOT, November 2006.
8. Initiative Plan: New Transportation Management Center at Anacostia Gateway, DDOT, January 27, 2006.
9. Standard Operating Procedures for Transportation Management Center (TMC), Operators Manual Version 4, Prepared for District of Columbia Division of Transportation, February 6, 2004, by DMJM&HARRIS.
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14. ATMS Concept of Operations, Version 0.7, VDOT, Northern Operations Region ATMS, Attachment D of RFP #173-BLW, January 2007.

15. ATMS Software Requirement Specifications Version 0.4, VDOT Northern Operations Region ATMS RFP # 173-BLW Attachment E, Trevilon Corporation, January 3, 2007.
16. Developing Functional Requirements for ITS Projects, Paul J. Gonzalez, Thomas B. Fowler, Mitretek Systems, Inc., April, 2002.
17. CHART II System Requirements, M361-RS-002R2, Computer Sciences Corporation and PB Farradyne Inc., May 2, 2000.
18. CHART Lite 3.0 System Design Document, Maryland State Highway Administration, September 2005.
19. Regional Integration Transportation Information System (RITIS), Center for Advanced Transportation Technology (CATT) Laboratory, All Hazards Forum, October 2006.
20. Metropolitan Washington Area ITS Architecture Interconnect Matrix, July 17, 2007.

1.5 Definitions

The following terms are used throughout this document:

1. **CIP Systems** – Critical Infrastructure Protection Systems (CIPS) is comprised of intelligent video systems (also known as "Smart Cameras") which use video analytics technology to detect stopped vehicles, pedestrians, packages, etc. in areas near critical infrastructure.

2. **External Agencies** – these are any agencies, outside of DDOT, including other agencies within the District of Columbia and surrounding areas, including the following:

    a. Maryland State Highway Administration (MD SHA);
    b. Virginia Department of Transportation (VDOT);
    c. Maryland Department of Transportation (MDOT);
    d. Montgomery County Department of Public Works & Transportation;
    e. Prince George's County Department of Public Works & Transportation;
    f. DC Unified Command Center (UCC);
    g. DC Public Safety;
    h. National Capital Region (NCR) Emergency Response;
    i. Metropolitan Washington Council of Governments (MWCOG);
    j. University of Maryland (UMD) Center for Advanced Transportation Technology (CATT);
    k. DC Department of Public Works (DC DPW);
    l. DC Water and Sewer Authority (DC WASA);
    m. National Warning System (NAWAS);
    n. Washington Metropolitan Area Transit Authority (WMATA);
    o. DC Homeland Security and Emergency Management Agency (HSEMA);
    p. DC Metropolitan Police Department (DC MPD).

3. **Intelligent Video Systems** – these are video-based systems that use image processing, video analytics, and other technologies to detect abnormal or suspicious behaviors, such as stopped vehicles, loitering pedestrians, unattended packages, etc.

4. **Permanent Count Station** – a traffic monitoring station that collects traffic speed, volume, occupancy, and classification data.

5. **SCADA** – Supervised Control and Data Acquisition (SCADA) are systems and applications that collect data from sensors and machines in remote locations and send them to a central computer for management and control. An example SCADA is DDOT's tunnel ventilation and control system.

6. **Traffic Detection Station** – a traffic monitoring station that collects traffic speed, volume, and occupancy data.

1.6 Document Organization

The document is organized as follows:

- Chapter 1 introduces the document, provides background information on CapTOP, provides a list of referenced documents, and defines the purpose and scope of the operational requirements;
- Chapter 2 provides the overall CapTOP system-level requirements, in terms of capabilities, attributes, and constraints of the system;
- Chapter 3 provides the interface requirements in terms of software and user interface, including the interface requirements between various components of the system, and interface requirements between the user and system;
- Chapter 4 is the main portion of this document and provides detailed requirements for each of the CapTOP operational areas.

2. SYSTEM-LEVEL REQUIREMENTS

The system level requirements describe the attributes and associated characteristics of the CapTOP system that provide the ATMS functionality required to support operations. The CapTOP system includes specific system-level requirements to address areas such as, manageability, maintainability, expandability, adaptability, availability, reliability, reusability, and others. These system attribute requirements will be used to produce a design that is responsive to these areas. These specialized requirements also define the system boundaries or constraints the CapTOP system must operate within to provide reliable, accurate, and seamless ITS services. The CapTOP system-level requirements are described in TABLE 4 below.

TABLE 4 System-Level Requirements

Source	ID	Requirement Description	Priority
SYS-4, ConOps 4.1, SMM-4, SMM-12	SR-SYS-1	CapTOP shall provide an open architecture with a modular design that supports the following features without the need for a major redesign: a. integration of legacy systems; b. scalability; c. extensibility; d. the addition of hardware, software and communication technologies as they become available; e. incorporation of new modules; f. incorporation of off-the-shelf software/hardware components; h. incorporation of new ITS devices; i. database expansion.	1
SMM-2	SR-SYS-2	CapTOP shall provide a client-server based architecture with the following features: a. uniform and unified user interfaces; b. a database management system; c. communications and application servers that allow the system to expand.	1
ConOps 4.1	SR-SYS-3	The system architecture of CapTOP shall be reconfigurable to accommodate system/module updates and expansions.	1
SYS-4	SR-SYS-4	CapTOP shall provide a low-coupling architecture and minimize inter-dependencies between the systems components.	1
SYS-6	SR-SYS-5	The CapTOP system architecture shall be both web-based and client-server based.	1
SYS-7	SR-SYS-6	CapTOP shall provide the ability to support variations in system configurations, and operations through database and configuration file settings.	1

Source	ID	Requirement Description	Priority
ConOps 1.3, SYS-4, SYS-1,SMM-2	SR-SYS-7	CapTOP shall utilize the following standards-based interfaces, data formats, databases, and protocols: a. NTCIP for communications with field devices/equipment and other TMCs; b. TCP/UDP as the communications protocol for the transport layer; c. XML for defining interface definitions; d. ANSI SQL for database definitions.	1
SYS-1,SMM-2	SR-SYS-8	To encourage vendor independence for field device communications, CapTOP shall utilize the latest published NTCIP standards for all NTCIP compliant field devices unless otherwise approved by DDOT.	1
SYS-8	SR-SYS-9	CapTOP shall provide a platform that provides integrated access to the following software applications: a. QuicNet 170E-based Signal System; b. Hansen; c. CityWorks; d. 2070-based Signal System; e. A contractor work-order tracking system for signal maintenance.	1
SYS-9	SR-SYS-10	CapTOP applications shall be designed for an event-driven approach to accommodate the following functions: a. event response planning; b. event management; c. event tracking; d. event analysis; e. event recording; f. event visualization.	1
ConOps 4.1	SR-SYS-11	CapTOP shall provide functions to support the management of the following activities: a. daily traffic; b. traffic incidents; c. special events; d. weather related events; e. work zone; f. Police emergencies.	1
SYS-10, SYS-11	SR-SYS-12	Access to all CapTOP functions/applications shall be provided from any CapTOP workstation within the DDOT network, subject to user privileges.	1
SYS-10, SYS-11	SR-SYS-13	CapTOP shall prohibit the use of dedicated workstations for specific functions.	1
SYS-10, SYS-11	SR-SYS-14	CapTOP shall provide a windows-based interface for TMC access to all CapTOP functions.	1
SYS-2, SYS-5	SR-SYS-15	CapTOP shall provide context-sensitive and online help to support training needs for all operator types.	1

Source	ID	Requirement Description	Priority
ConOps 4.1	SR-SYS-16	CapTOP shall provide a platform to support information sharing among DDOT personnel and external organizations.	1
ConOps 4.1	SR-SYS-17	CapTOP shall support an alarm capability, whereby various events can be configured as different alarm types.	1
ConOps 4.1	SR-SYS-18	Each CapTOP alarm type shall be able to be configured to have an audible, color, and the following methods for notification: a. event display; b. pop-up window; c. e-mail message; d. text message; e. message board.	1
ConOps 4.1	SR-SYS-19	CapTOP alarms shall be date and time stamped.	1
ConOps 4.1	SR-SYS-20	CapTOP alarms shall be filterable by type.	1
ConOps 4.1	SR-SYS-21	CapTOP alarms shall be searchable.	1
ConOps 4.1	SR-SYS-22	CapTOP shall provide comprehensive reporting tools for system performance, measurement and evaluation in the following operational areas: a. Traffic signal management; b. CCTV management; c. DMS management; d. PDMS management; e. HAR management; f. Vehicle detector management; g. RWIS management; h. Incident response times; i. Incident durations; j. Operator productivity; k. Operator effectiveness; l. CapTOP management.	1
ConOps 4.1	SR-SYS-23	CapTOP shall provide the TMC Operator with operational functions to monitor and control the following field devices: a. 170E-based traffic signals (monitoring only via QuicNet); b. 2070-based traffic signals (monitoring only via the future Traffic Signal System); c. CCTV cameras; d. DMS; e. PDMS; f. HAR; g. RWIS; h. detectors/sensors; i. WIM stations; j. vehicle detection/permanent count stations.	1

Source	ID	Requirement Description	Priority
ConOps 4.1	SR-SYS-24	CapTOP shall be able to facilitate the dissemination of timely, accurate information through the following devices and methods: a. HAR; b. DMS; c. the Internet; d. traveler information kiosks; e. automated telephone based information systems; f. text messages; g. instant messages; h. e-mail messages.	1
ConOps 4.1	SR-SYS-25	CapTOP shall integrate a database management system with functions for collection, integration, analysis, archiving, and reporting for the following types of data: a. traffic and road condition data; b. weather-related road conditions; c. weather-related warnings and closures; d. work zone data and restrictions; e. incident data.	1
New Need 1	SR-SYS-26	CapTOP shall provide a configuration function to allow authorized users to modify the following system configuration data: a. user permissions; b. equipment/device settings for all ITS device types; c. communication settings.	1
ConOps 4.1	SR-SYS-27	CapTOP shall provide the ability to monitor and record the operator actions and field resources required to respond to incidents and special events.	1
ConOps 4.1, RTC-2, RTC-8, RTC-9, RTC-10, RTC-12, RTC-15	SR-SYS-28	CapTOP shall provide an interface with the following systems to support regional transportation management by communicating and sharing information using standards-based center-to-center protocols (NTCIP and XML): a. CHART; b. NOVA OpenTMS; c. MWCOG; d. RITIS; e. DDOT CIPS; f. DDOT Snow Operations; g. DC UCC; h. DC Public Safety; i. NCR Emergency Response; j. CapWIN; k. WASA; l. NAWAS; m. 511; n. WMATA.	1, items a and b are priority 3

Source	ID	Requirement Description	Priority
SEPM-26	SR-SYS-29	CapTOP shall provide a web-based interface with the external agencies to share the following traffic information: a. incidents; b. congested areas; c. special events; d. signal status; e. ITS device status; f. live video; g. road closures; h. lane closures; i. construction zones; j. maintenance operations; k. traffic condition data; l. weather-related road conditions; m. weather-related warnings; n. weather-related closures.	1
IM-49	SR-SYS-30	CapTOP shall provide a web-based interface to access CapTOP remotely from other locations.	1
SYS-10, SYS-11, IM-49	SR-SYS-31	CapTOP shall provide a secure web-based interface to support remote access of CapTOP functions from outside the DDOT network, subject to user privileges.	1
IM-5	SR-SYS-32	CapTOP shall provide a web-based interface to view information from the following partners in other jurisdictions: a. SHA; b. VDOT; c. MWCOG; d. RITIS; e. DDOT CIPS; f. DDOT Snow Operations; g. DC UCC; h. DC Public Safety; i. NCR Emergency Response; j. CapWIN; k. WASA; l. NAWAS; m. WMATA.	1
New Need 2	SR-SYS-33	CapTOP shall support multi-levels of security to control user access.	1
New Need 3	SR-SYS-34	CapTOP shall provide the capability for the system administrator to assign the security level when a user account is created.	1
New Need 4	SR-SYS-35	CapTOP shall provide the capability for each subsystem and critical function to have user account-level settings for read-only, control, and override.	1

Source	ID	Requirement Description	Priority
ConOps 4.1	SR-SYS-36	CapTOP shall be able to automatically generate real-time reports for: a. device equipment status by subsystem (DMS, PDMS, CCTV, HAR, Traffic Signals, RWIS, Vehicle Detectors, WIM Stations, and Vehicle detection/Permanent count stations); b. signals status.	1
ConOps 4.1	SR-SYS-37	CapTOP shall provide the MPD and the Capitol Police with access to the CapTOP system to view the status of roadways, traffic signals, incidents, and devices under the control of the Capital Police.	2

3. USER INTERFACE REQUIREMENTS

This section provides a list of user interface requirements based upon the user needs and use case scenarios described in previous documents. These user interface requirements document how users interact with the system to view, monitor, and control ITS devices and traffic signals. These user interface requirements also document how data is entered and displayed within the system. The interface user requirements are divided into interface requirements and user requirements.

As documented in the ConOps document, the potential user groups of CapTOP are as follows:

- External User (including normal operators and read-only guests)
- Maintenance Manager (also known as Maintenance Supervisor)
- Maintenance Technician
- ROP Driver
- ROP Manager (also known as Operations Manager)
- System Administrator (including database managers/administrators)
- TMC Manager
- TMC Operator
- Transportation Planner
- Traffic Engineer

The responsibilities of each CapTOP user group are addressed in ConOps document. The TMC manager has the ability to configure and assign privileges for user accounts based on their operational responsibilities. User privileges range from monitoring and control of all subsystems (as may be done for supervisors) to monitoring/read-only rights for others (as may be done for guests or external users).

3.1 Interface Requirements

The CapTOP interface requirements are described in TABLE 5 below.

TABLE 5 Interface Requirements

Source	ID	Requirement Description	Priority
ConOps 3.1	IR-GUI-1	CapTOP shall use the following types of user interfaces: a. graphics-based; b. GIS map-based; c. web-based interfaces.	1
GUI-15, GUI-27, GUI-35	IR-GUI-2	CapTOP shall provide GIS map-based displays that are able to display location-based real time data.	1
GUI-15, GUI-27, GUI-35	IR-GUI-3	CapTOP shall provide GIS map-based displays that are able to display location-based historical data.	1
GUI-15, GUI-27, GUI-35, GUI-39	IR-GUI-4	CapTOP shall provide color-coded maps to display traffic condition data.	1
GUI-42	IR-GUI-5	The CapTOP GIS map-based display shall be available to the operator via the CapTOP workstation.	1
GUI-42	IR-GUI-6	CapTOP shall allow the display of map-based traffic condition data to the public in real-time via the Internet.	1
GUI-15, GUI-27, GUI-35	IR-GUI-7	CapTOP shall provide tabular reports for the following: a. Current incidents sortable by location and time opened; b. Historical incidents sortable by location, time opened, and time closed; c. Device (DMS, PDMS, CCTV, HAR, Traffic Signals, RWIS, Vehicle Detectors, WIM Stations, Vehicle detection/Permanent count stations) status reports sortable by Device ID, location, and communication status.	1
GUI-15, GUI-27, GUI-35	IR-GUI-8	CapTOP shall provide the ability to exchange map data and spatial data with other agencies.	1

Source	ID	Requirement Description	Priority
ConOps 4.1	IR-GUI-9	CapTOP shall provide a map-based display with icon layers to spatially present location-based information for the following: a. traffic signals; b. CCTV cameras; c. DMS; d. PDMS; e. HAR; f. RWIS; g. detectors/sensors; h. WIM stations; i. vehicle detection/permanent count stations; j. incidents; k. work zones.	1
DOC-17	IR-GUI-10	CapTOP shall display the location for traffic signals and ITS devices based on location information provided by DDOT.	1
ConOps 4.1	IR-GUI-11	CapTOP shall allow users to turn on/off layers of a map-based display as desired.	1
GUI-1	IR-GUI-12	CapTOP shall provide a monitoring and control interface through communication servers for the following ITS devices: a. CCTV cameras; b. DMS; c. PDMS; d. HAR.	1
GUI-1	IR-GUI-13	CapTOP shall provide a monitoring-only interface through communication servers for the following ITS devices: a. RWIS; b. Vehicle Detectors/Sensors; c. WIM stations; d. Vehicle detection/Permanent count stations; e. Traffic Signals.	1
GUI-4	IR-GUI-14	CapTOP shall allow users to monitor and control ITS devices under one common Graphical User Interface (GUI) using a standard set of control windows, pull-down menus, push-buttons, and mouse activated icons.	1
DOC-17	IR-GUI-15	CapTOP shall provide the TMC Operator a map-based display to show current roadway condition, ITS device status information, and traffic signal status information.	1

Source	ID	Requirement Description	Priority
DWA-10	IR-GUI-16	CapTOP shall be capable of communicating to devices using the following communication media: a. regular telephone lines; b. wireless connections; c. leased lines; d. twisted pair; e. internet connections; f. network connections.	1
IM-2, IM-44	IR-GUI-17	CapTOP shall provide for multi-user capabilities where two or more different users, at two or more different CapTOP workstations, can simultaneously access the system through the GUI, subject to operator access-level restrictions.	1
IM-2, IM-44	IR-GUI-18	CapTOP shall provide for multi-user capabilities where two or more different remote users, can simultaneously access the system through the web-based interface, subject to operator access-level restrictions.	1
GUI-34	IR-GUI-19	CapTOP shall provide a capability that allows the operator to right-mouse click on the map to quickly create an incident at the location clicked.	1
GUI-17, GUI-35	IR-GUI-20	CapTOP shall allow the TMC operator to manually input incident data by launching the incident entry/update screens from the map display.	1
GUI-17, GUI-35	IR-GUI-21	CapTOP shall allow the TMC operator to manually input incident data by launching the incident entry/update screens from the CapTOP toolbar.	1
GUI-17, GUI-35	IR-GUI-22	CapTOP shall allow the TMC operator to update incident data received electronically and that which was manually entered.	1
GUI-29	IR-GUI-23	CapTOP shall allow users to enter the location of new incidents using the following methods: a. geocoding; b. street address; c. latitude/longitude; d. cross streets.	1
GUI-12	IR-GUI-24	CapTOP shall provide a map-based display with geographically accurate street maps of the following: a. interstates; b. state routes; c. arterials; d. surface streets; e. residential streets.	1

Source	ID	Requirement Description	Priority
GUI-12	IR-GUI-25	CapTOP shall provide map-based displays that display color-coded icons of surveillance and control devices to reflect the current real-time status for the following: a. traffic signals; b. CCTV cameras; c. DMS; d. PDMS; e. HAR; f. RWIS; g. detectors/sensors; h. WIM stations; i. vehicle detection/permanent count stations.	1
GUI-12	IR-GUI-26	CapTOP shall display the device icons spatially on the map displayed, based on their physical geographic location.	1

GUI-12, DDM-18, DDM-21, DDM-23, DDM-24, DDM-29, DDM-37	IR-GUI-27	CapTOP shall use the following colors for device icon states:
		a. Green = on-line;
		b. Green with Yellow in middle = on-line and message display (DMS/HAR only);
		c. Red = device failure;
		d. Yellow = communication failure.
			1

GUI-12, DDM-18, DDM-21, DDM-23, DDM-24, DDM-29, DDM-37	IR-GUI-28	CapTOP shall allow the Operator to obtain detailed device status information by clicking on the device icon on the map display.	1
GUI-12, DDM-18, DDM-21, DDM-23, DDM-24, DDM-29, DDM-37	IR-GUI-29	CapTOP shall allow the Operator to obtain detailed device status information by using the CapTOP toolbar and searching for the device ID.	1
GUI-14	IR-GUI-30	CapTOP shall provide a map-based display that provides the ability to integrate information/data from multiple sources on different map layers.	2
GUI-24	IR-GUI-31	CapTOP shall allow users to set up camera "tours" that present views of multiple cameras in pre-defined sequences.	1
GUI-25, GUI-30, GUI-31, GUI-35, SEPM-48, SEPM-49, SEPM-50, SEPM-52	IR-GUI-32	CapTOP shall provide a map-based display of locations that displays icons which represent the following: a. incidents; b. special events; c. road closures; d. lane closures; e. construction zones; f. maintenance operations.	1

Source	ID	Requirement Description	Priority
GUI-39	IR-GUI-33	CapTOP shall be able to display detailed information for special events, incidents, and emergencies by allowing the operator to click on the icon associated with those events.	1
GUI-25, GUI-30, GUI-31, GUI-35	IR-GUI-34	CapTOP shall provide the TMC Operator a map-based display to show up-to-date ITS device status information.	1
GUI-26	IR-GUI-35	CapTOP shall provide visual message alerts when a system/device status changes.	1
GUI-33	IR-GUI-36	CapTOP shall provide users a simplified incident form to enter key incident attributes.	1
GUI-33	IR-GUI-37	CapTOP shall require the following fields to be entered before the incident record can be saved: a. location b. type of incident	1
GUI-34	IR-GUI-38	CapTOP shall provide a search map feature that allows users to enter intersection street names to quickly locate an incident location.	1
GUI-34	IR-GUI-39	CapTOP shall provide a search map feature that allows users to enter street addresses to quickly locate an incident location.	1
GUI-39	IR-GUI-40	CapTOP shall be able to display roadway traffic condition information using color-coded maps to display the following: a. color coded traffic network links that display the following: 1. speed where green = free-flow; orange = congested; red = stopped; 2. occupancy where green = free-flow; orange = congested; red = stopped; 3. volume where green = low volume; orange = medium volume; red = high volume; b. icons to indicate the location of accidents; c. icons to indicate the location of road closures.	1
GUI-40	IR-GUI-41	CapTOP shall allow Snow Center staff to access the following information via a CapTOP map display from the Snow Center: a. incidents; b. traffic congestion, with access to traffic volume; c. road closures.	1
GUI-41	IR-GUI-42	CapTOP shall interface with QuicNet to access the following information on the 170E signal system: a. alarms; b. alerts; c. status; d. signal timing plans.	1

Source	ID	Requirement Description	Priority
New Need 5	IR-GUI-43	CapTOP shall interface with the 2070-based signal system (not the controllers) to access the following information: a. alarms; b. alerts; c. status; d. signal timing plans.	1
SEPM-48,SEPM-49, SEPM-50, SEPM-52	IR-GUI-44	CapTOP shall provide a map-based display to show the following details in regard to each special event: a. road closures; b. parking restrictions; c. DMS used; d. PDMS used; e. number of traffic cones/barriers required; f. location of any ROPs; g. location of Police Mobile Command centers.	1
TOM-5, TOM-6	IR-GUI-45	CapTOP shall provide the TMC Operator a map-based display to show and monitor the following operations on roadways: a. configuration of reversible lane facilities; b. one-way streets; c. lane/turning restrictions.	1
TDCA-4	IR-GUI-46	CapTOP shall provide a map-based display to show speed data captured from the interface with the SpeedInfo data server.	1
TDCA-5	IR-GUI-47	CapTOP shall provide a map-based display with the Traffic.com data server to receive and display the following: a. speed; b. volume; c. occupancy.	1
GUI-17	IR-GUI-48	CapTOP shall provide users with the following GUI components to monitor and control the system: a. drop-down menus for issuing commands to the system; b. mouse clicking and dragging; c. text input; d. buttons for issuing commands to the system; e. graphical objects to display data; f. GIS-based graphical maps; g. CapTOP toolbar with menus and icons to access CapTOP functions.	1
GUI-13	IR-GUI-49	CapTOP shall provide a map-based display to show the signalized intersection locations.	1

Source	ID	Requirement Description	Priority
GUI-13, SIG-1, SIG-3	IR-GUI-50	CapTOP shall provide a map-based display to show the following information about each signalized intersection: a. location; b. Controller type; c. current timing plan in effect; d. split, cycle, offsets (as applicable); e. physical geometry of the intersection illustrated graphically; f. the current signal status (red, yellow, green) of each approach.	1
GUI-19	IR-GUI-51	CapTOP shall provide the ability to display work zone status on the map display.	2
GUI-19, CMM-6	IR-GUI-52	CapTOP shall provide a map-based display to show the following: a. current location and status of active work zones; b. current location of AVL-tracked vehicles for each active work zone.	2
GUI-19, CMM-6	IR-GUI-53	CapTOP shall provide a map-based display to show the following: a. location and status of historical work zones; b. location of AVL-tracked vehicles for each historical work zone.	2
GUI-19	IR-GUI-54	CapTOP shall provide the ability for the operators to update the status and locations of work zones through CapTOP menus.	2
GUI-21, GUI-43, SEPM-47	IR-GUI-55	CapTOP shall provide a map-based display to show the following information: a. lane closure status; b. lane closure times (starting and expected ending times for the lane closure); c. which lane(s) are closed.	2
GUI-38	IR-GUI-56	CapTOP shall provide a map-based display to automatically display alternative routes when a major road is blocked due to an incident/event.	2
SEPM-55	IR-GUI-57	CapTOP shall provide a map-based display via the Internet to provide information about special event traffic control plans ahead of time to the public.	2
WEM-12	IR-GUI-58	CapTOP shall provide a map-based display to show the following weather-related information obtained from the StormTrak system: a. Snow operation routes; b. Snow operation route status (time last treated); c. Snow route conditions (treated and drivable, needs treatment).	2
WEM-14, WEM-8	IR-GUI-59	CapTOP shall provide a map-based display to track the location of snow removal vehicles with AVL technology.	2

Source	ID	Requirement Description	Priority
WEM-14, WEM-8	IR-GUI-60	CapTOP shall provide a map-based display to show snow removal routes which have been assigned to a snow removal vehicles.	2

3.2 User Requirements

The CapTOP user requirements are described in TABLE 6.

TABLE 6 User Requirements

Source	ID	Requirement Description	Priority
ConOps-5.3	UR-TO-1	CapTOP shall provide the TMC Operator with the ability to monitor and manage the following: a. incidents; b. special events; c. ITS roadside devices.	1
ConOps-5.3	UR-TO-2	CapTOP shall provide error checks, range checks, and consistency checks of all operator input fields.	1
ConOps-5.3	UR-TO-3	CapTOP shall provide consistency checks to ensure entries between fields are consistent based on programmed limitations.	1
ConOps-5.3	UR-TO-4	CapTOP shall generate and display error messages to indicate which fields contain invalid data and allow the operator to re-enter rejected data.	1
ConOps-5.3	UR-TO-5	CapTOP shall allow the TMC Operator to select incidents, lane/road closures, network segments, and ITS devices by boxing an area on the map display.	1
ConOps-5.3	UR-TO-6	CapTOP shall allow the TMC Operator to de-select incidents, lane/road closures, network segments, and ITS devices by boxing an area on the map display.	1
ConOps-5.3	UR-TO-7	CapTOP shall allow the TMC Operator to select incidents, lane/road closures, network segments, and ITS devices by selecting an icon on the map display.	1
ConOps-5.3	UR-TO-8	CapTOP shall allow the TMC Operator to de-select incidents, lane/road closures, network segments, and ITS devices by selecting an icon on the map display.	1

Source	ID	Requirement Description	Priority
ConOps-5.3	UR-TO-9	The CapTOP GUI shall be designed to ensure that the TMC Operator can enter a minimum number of keystrokes and not be required to memorize any commands in order to access a function.	1
ConOps-5.3	UR-TO-10	CapTOP shall provide on-line help for all functions and features.	1
DWA-12, DWA-14, SMM-6, ConOps 4.1	UR-TO-11	CapTOP shall log the following user activities: a. login; b. logout; c. displays viewed; d. commands to signals; e. commands to ITS devices; f. incident updates; g. response plan actions; h. transmitted notifications; i. device configuration updates; j. any updates to the database and configuration files; k. any messages transmitted to external organizations.	1
ConOps-5.3	UR-TO-12	CapTOP shall record and time stamp all TMC Operator activities and provide the output in a time sequential log.	1
ConOps-5.3	UR-TO-13	CapTOP shall provide the TMC Operator with appropriate methods for communicating and interfacing with the following internal and external agencies: a. Snow Center; b. EMA; c. DPW; d. MPD.	1
ConOps-5.3	UR-TO-14	CapTOP shall provide the following functions in regard to incident and special event management: a. verification through CCTV; b. response through automated response plans; c. recording using database updates; d. notifications to internal and external agencies.	1
ConOps-5.3	UR-TO-15	CapTOP shall allow the TMC Operator to monitor the following types of alerts: a. 911 alerts for traffic incidents; b. WMATA Metro Rail alerts via XML; c. Metro Bus alerts via XML; d. CVISN overweight alerts; e. CIPS incident alerts; f. Police amber alerts.	1

Source	ID	Requirement Description	Priority
ConOps-5.3	UR-TO-16	CapTOP shall provide incident alerts to other agencies through the interface with the National Warning System.	1
ConOps-5.3	UR-TO-17	CapTOP shall provide the TMC Manager the ability to perform the following functions: a. schedule operator assignments; b. monitor TMC Operators' quality of work; c. supervise daily routine traffic management functions; d. access the system log file.	1
ConOps-5.3	UR-TO-18	CapTOP shall provide the TMC Manager the capability to document outcomes of traffic management schemes, using the CapTOP traffic management database and the system event log.	1
ConOps-5.3	UR-TO-19	CapTOP shall provide the TMC Manager the capability to document outcomes of incident response efforts, using the CapTOP incident database and the system event log.	1
ConOps-5.3	UR-TO-20	CapTOP shall provide the TMC Manager with performance reports regarding TMC response to incidents, using the CapTOP database and the system event log.	1
ConOps-5.3	UR-TO-21	CapTOP shall provide the TMC Manager the ability to monitor traffic condition and incident status information using the map display, status logs, and incident database.	1
ConOps-5.3	UR-TO-22	CapTOP shall provide the TMC Manager the ability to share traffic and weather-related information with other agencies and jurisdictions for the following types of activities: a. special events; b. regional weather events; c. major incidents.	1
ConOps-5.3	UR-TO-23	CapTOP shall provide the Maintenance Manager the ability to perform the following: a. manage the following maintenance resources: 1. vehicles; 2. spare parts; 3. personnel. b. monitor Maintenance Technician activities; c. supervise maintenance services provided by Contractors; d. communicate with other agencies to provide field device status.	2
ConOps-5.3	UR-TO-24	CapTOP shall provide the Maintenance Manager the ability to create, schedule, and monitor the status of work orders for Maintenance Technicians.	2

Source	ID	Requirement Description	Priority
ConOps-5.3	UR-TO-25	CapTOP shall provide the Maintenance Technician the ability to monitor the performance and the status of the following: a. the following TMC equipment: 1. TMC workstations; 2. TMC servers; 3. TMC video equipment. b. the following ITS field devices: 1. CCTV cameras; 2. DMS; 3. PDMS; 4. HAR; 5. RWIS; 6. detectors/sensors; 7. WIM sensors; 8. vehicle detection/permanent count stations. c. communication networks; d. traffic signals.	1
ConOps-5.3	UR-TO-26	CapTOP shall provide ROP Managers the ability to monitor and log ROP drivers' activities through the following CapTOP features: a. receiving and displaying in-vehicle ROP cameras; b. tracking ROP vehicular movements using in-vehicle GPS; c. confirming ROP response at particular incidents; d. communication with ROP drivers two-way via radios; e. logging ROP responses in the CapTOP incident database.	2
ConOps-5.3	UR-TO-27	CapTOP shall provide ROP drivers remote access capabilities to exchange the following information with the TMC Operator and ROP Supervisor: a. incident notifications; b. incident response requests; c. updated incident status.	2
ConOps-5.3	UR-TO-28	CapTOP shall provide System Administrators the capability to create and maintain the following: a. user group definitions; b. user security privileges; c. system configuration data; d. ITS device configuration data; e. CapTOP database.	1
ConOps-5.3	UR-TO-29	CapTOP shall provide System Administrators the capability to view the following: a. system event logs; b. user logs.	1

Source	ID	Requirement Description	Priority
SYS-12	UR-TO-30	CapTOP shall provide System Administrators access to troubleshooting tools to diagnose problems with the following: a. ITS field devices; b. CapTOP database; c. workstation and server performance; d. network performance.	1
ConOps-5.3	UR-TO-31	CapTOP shall provide remote users, not connected to the DDOT network, the ability to view the following: a. traffic condition information; b. video; c. road weather information; d. incident information; e. traffic signal status; f. ITS device status.	1
ConOps-5.3	UR-TO-32	CapTOP shall provide remote users, not connected to the DDOT network, the ability to update incident information and control ITS devices, subject to user privileges.	1

4. OBJECTIVE REQUIREMENTS

This section includes objective requirements that are required to satisfy the user needs and the necessary operational functions. Requirements are grouped into various categories and prioritized. The last column in each table indicates the priority (1 = highest).

4.1 Amber Alert

Refer to requirement OR-IM-69 in Section 4.12.

4.2 Asset Management

The CapTOP asset management objective requirements are described in the following sections:

- Refer to requirements OR-DDM-1, OR-DDM-13, and OR-DDM-18 in Section 4.8
- Refer to requirements OR-SEPM-9 in Section 4.17

4.3 Center-to-Center Communication

The CapTOP center-to-center (C2C) operational requirements are described in TABLE 7.

TABLE 7 C2C Operational Requirements

Source	ID	Requirement Description	Priority
C2C-1	OR-C2C-1	CapTOP shall provide a custom two-way communication interface from the TMC to RITIS to share the following information: a. incidents; b. congested areas; c. special events; d. signal status; e. ITS device status; f. live video; g. road closures; h. lane closures; i. construction zones; j. maintenance operations; k. traffic condition data; l. weather-related road conditions; m. weather-related warnings; n. weather-related closures.	1
C2C-1	OR-C2C-2	CapTOP shall provide a "generic" two-way communication interface from the TMC to other agencies to share the following information: a. incidents; b. congested areas; c. special events; d. signal status; e. ITS device status; f. live video; g. road closures; h. lane closures; i. construction zones; j. maintenance operations; k. traffic condition data; l. weather-related road conditions; m. weather-related warnings; n. weather-related closures.	1
C2C-3	OR-C2C-3	CapTOP shall support center-to-center communication via the NTCIP protocol to facilitate interagency communications and data exchange with other TMCs.	2
C2C-3	OR-C2C-4	CapTOP shall support center-to-center communication using XML interface definitions to facilitate interagency communications and data exchange with other TMCs.	2

4.4 Center-to-Field Communication

The CapTOP center-to-field (C2F) operational requirements are described in TABLE 8 below.

TABLE 8 C2F Operational Requirements

Source	ID	Requirement Description	Priority
ConOps 3.1	OR-C2F-1	CapTOP shall be able to access traffic surveillance information on a real-time basis via the C2F communication interface.	1
C2F-1	OR-C2F-2	CapTOP shall provide the TMC Operator ability to retrieve and downloaded data from the field devices and store in the CapTOP database.	1
C2F-3	OR-C2F-3	CapTOP shall provide interfaces to communicate with the legacy ITS devices as well as new devices.	1

4.5 Critical Infrastructure Protection

The CapTOP Critical Infrastructure Protection (CIP) operational requirements are described in TABLE 9.

TABLE 9 CIP Operational Requirements

Source	ID	Requirement Description	Priority
CIP-1,CIP-8	OR-CIP-1	CapTOP shall provide the ability to receive alerts and alarms and notify users when CIP systems detect suspicious activity in tunnels, on bridges, and at other critical infrastructure locations.	1
CIP-4	OR-CIP-2	CapTOP shall be able to receive CIP alerts in the form of data and video.	1
CIP-7	OR-CIP-3	CapTOP shall provide an interface with Intelligent Video Systems installed in tunnels, on bridges, and at other critical infrastructure locations to display incident locations on the CapTOP map.	2
CIP-2, CIP-3, CIP-5	OR-CIP-4	CapTOP shall provide the TMC Operator with functions to monitor suspicious activity at critical infrastructure locations using Intelligent Video Systems from CIP monitoring stations.	1

4.6 Construction and Maintenance Management

The CapTOP construction and maintenance management operational requirements are described in TABLE 10 below.

TABLE 10 Construction and Maintenance Management Operational Requirements

Source	ID	Requirement Description	Priority
GUI-19	OR-CMM-1	CapTOP shall provide the ability to obtain work zone locations and status received from other DC agencies.	2
CMM-1, CMM-2, CMM-4, CMM-7	OR-CMM-2	CapTOP shall provide an interface with other DC agencies to access the work zone database to obtain the following data: a. the list of authorized full and partial short-term road closures. b. the list of authorized full and partial long-term road closures. c. the allowable work hours and lane closure times, setup times, infrastructure repair description, and road obstructions.	2
CMM-3	OR-CMM-3	CapTOP shall generate automated alerts to operators to provide reminders of when work zones are to be setup and taken down.	2
CMM-2, CMM-8	OR-CMM-4	CapTOP shall allow the Operator to monitor traffic conditions, road weather conditions, incident and video information.	3
CMM-2, CMM-8	OR-CMM-5	CapTOP shall allow the Operator to disseminate traffic condition, incident, video, and road weather conditions to DPW to support maintenance and construction planning activities.	3
CMM-8	OR-CMM-6	CapTOP shall disseminate the following work zone information to the public via the Internet: a. planned maintenance - road, lanes, start/end date and times; b. planned construction- road, lanes, start/end date and times; c. unplanned maintenance- road, lanes, start/end date and times; d. unplanned construction- road, lanes, start/end date and times.	2

4.7 CVISN

The CapTOP Commercial Vehicle Information Systems and Networks (CVISN) operational requirements are described in TABLE 11 below.

TABLE 11 CVISN Operational Requirements

Source	ID	Requirement Description	Priority
CVSN-8	OR-CVSN-1	CapTOP shall be able to send MPD and other agencies alerts and notifications when the determination is made that a security threat exists due to an unauthorized commercial vehicle that bypasses a inspection station.	2
CVSN-8	OR-CVSN-2	CapTOP shall be able to send MPD and other agencies alerts and notifications when a HAZMAT vehicle is encountered.	2
CVSN-5	OR-CVSN-3	CapTOP shall provide the TMC Operator with access to information regarding height restrictions, weight restrictions, and routes that are inappropriate for heavy and oversized vehicles.	2
CVSN-5, CVSN-6	OR-CVSN-4	CapTOP shall be able to access and display truck routes with weight restrictions on the CapTOP map display.	2
CVSN-7	OR-CVSN-5	CapTOP shall provide an interface with CVISN's Roadside Operations Computers (ROCs) to access the following CVISN information: a. video; b. vehicle data (speed, volume, classification and weight); c. overweight vehicle alarms; d. messages displayed on CVISN's DMS signs; e. AVL data for monitoring movement at the TMC for HAZMAT movements and oversized/special permit vehicle movements.	2 overall, 3 for item e
CVSN-1, CVSN-4	OR-CVSN-6	CapTOP shall be able to notify the TMC Operator of overweight truck alarms received via an interface with CVISN's ROCs.	2
CVSN-2	OR-CVSN-7	CapTOP shall provide an interface with the CVISN E-Screening Program to access WIM information and report on real-time overweight trucks.	2
CVSN-5, CVSN-6	OR-CVSN-8	CapTOP shall be able to access and display truck routes with height restrictions on the CapTOP map display.	2
CVSN-2	OR-CVSN-9	CapTOP shall provide the following pre-trip incident information to the CVO truckers and dispatchers delivered via the internet: a. the following incident information along truck routes: 1. accidents; 2. congestion; 3. construction activities; 4. special events; 5. road closures. b. information on alternate routes in the event of major incidents and special events; c. special events that may affect truck routes; d. maximum vehicle heights at low bridges/underpasses; e. weight restrictions displayed by road/location.	2

Source	ID	Requirement Description	Priority
CVSN-2	OR-CVSN-10	A CapTOP workstation shall be available at the CVISN scale house to provide access to the following general information: a. incidents; b. congested areas; c. special events; d. signal status; e. ITS device status; f. live video; g. road closures; h. lane closures; i. construction zones; j. maintenance operations; k. traffic condition data; l. weather-related road conditions; m. weather-related warnings; n. weather-related closures.	2
CVSN-2, IM-32	OR-CVSN-11	CapTOP shall provide the CVSN Operator with the following information that is tailored for the CVO community: a. incident information regarding accidents, special events, construction and congestion events along main truck routes; b. information on alternate routes in the event of major incidents and special events; c. special events that may affect truck routes; d. truck routes with weight restrictions displayed by road/location. e. truck routes with height restrictions displayed by road/location with low bridges/underpasses clearly identified.	2
CVSN-2	OR-CVSN-12	CapTOP shall provide the following en-route incident information to the CVO truckers and dispatchers delivered via DMS/PDMS and HAR along truck routes: a. accidents; b. congestion; c. construction activities; d. special events; e. road closures.	2

4.8 Device Diagnostics and Maintenance

The CapTOP device diagnostics and maintenance operational requirements are described in TABLE 12 below.

TABLE 12 Device Diagnostics and Maintenance Operational Requirements

Source	ID	Requirement Description	Priority
DDM-1, DDM-3	OR-DDM-1	CapTOP shall interface with a Commercial-Off-The-Shelf (COTS) asset management system for managing the following maintenance activities: a. work order generation; b. work order scheduling; c. work order tracking.	1
DDM-34	OR-DDM-2	CapTOP shall be able to initiate work order requests through CityWorks for problems involving ITS devices.	1
DDM-34	OR-DDM-3	CapTOP shall be able to initiate work order requests through the Signal Maintenance Contractor's database for problems involving the signal system.	1
DDM-12	OR-DDM-4	CapTOP shall provide the TMC Maintenance Staff the capability to generate, update, and close work orders and reports from the DDOT LAN and from remote locations.	1
DDM-11	OR-DDM-5	CapTOP shall provide Maintenance Staff a web-based interface to create, update, and close work orders remotely.	1
DDM-16	OR-DDM-6	CapTOP shall support an electronic inventory system that manages and provides information on spare parts availability for the DDOT stock room.	1
DDM-16	OR-DDM-7	CapTOP shall support an electronic inventory system that manages and provides information on spare parts availability for the Contractor stock room.	2
DDM-2	OR-DDM-8	CapTOP shall provide the Maintenance Staff and TMC Operator the ability to <u>enter</u> the following types of work orders: a. new device/equipment installation; b. preventive maintenance; c. corrective maintenance; d. problem reports from citizens.	1
DDM-2	OR-DDM-9	CapTOP shall provide the Maintenance Staff and TMC Operator the ability to <u>update</u> the following types of work orders: a. new device/equipment installation; b. preventive maintenance; c. corrective maintenance; d. problem reports from citizens.	1
DDM-2	OR-DDM-10	CapTOP shall provide the Maintenance Staff and TMC Operator the ability to <u>delete</u> the following types of work orders: a. new device/equipment installation; b. preventive maintenance; c. corrective maintenance; d. problem reports from citizens.	1

Source	ID	Requirement Description	Priority
DDM-2	OR-DDM-11	CapTOP shall provide the Maintenance Staff and TMC Operator the ability to generate the follow type of reports: a. list of all work orders sorted by date/time; b. list of open work orders sorted by date/time; c. list of closed work orders sorted by date/time; d. list of all work orders sorted by maintenance technician and then date/time; e. list of open work orders sorted by maintenance technician and then date/time; f. list of closed work orders sorted by maintenance technician and then date/time; g. list of all work orders sorted by originator and then date/time; h. list of open work orders sorted by originator and then date/time; i. list of closed work orders sorted by originator and then date/time.	1
DDM-20	OR-DDM-12	CapTOP shall allow users to create reports that identify the status of following problem areas that have not yet been resolved: a. ITS device failures; b. ITS device malfunctions; c. signal controller failures; d. signal controller malfunctions.	1
DDM-25	OR-DDM-13	CapTOP shall be able to produce a problem report and transmit to Maintenance Staff via an integrated asset management system.	1
DDM-28	OR-DDM-14	CapTOP shall provide the capability to allow the TMC Operator to communicate with Maintenance Technicians in the field and to obtain real-time device status information to confirm maintenance repairs.	1
DDM-33	OR-DDM-15	CapTOP shall be able to generate ITS device maintenance reports and allow Maintenance Staff to customize the reports for each ITS subsystem.	1
DDM-18, DDM-21, DDM-23, DDM-24, DDM-29, DDM-37	OR-DDM-16	CapTOP shall be able to alert Maintenance Staff and the TMC Operator when there is a field device malfunction and when there is a field device status change.	1
DDM-10	OR-DDM-17	CapTOP shall allow the Maintenance Technician to receive, create, update, and close work orders in the field through the use of PDAs and wireless enabled laptops.	2
DDM-5, DDM-34, DDM-35, DDM-41	OR-DDM-18	CapTOP shall provide a seamless interface with the CityWorks to utilize its asset management capabilities and features.	1
DDM-13, DDM-14, DDM-15	OR-DDM-19	CapTOP shall provide Maintenance Staff with a function to test and diagnose device/equipment problems remotely.	1

Source	ID	Requirement Description	Priority
DDM-8, DDM-36	OR-DDM-20	CapTOP shall allow the System Administrator to perform the following: a. to add, remove and change device icons on the map display; b. to add, remove and change ITS device configuration information stored in the central system; c. to add, remove, and change ITS device configuration information stored in the device.	1
DDM-17	OR-DDM-21	CapTOP shall log the faults, errors, and system alarms of all field devices, and be able to generate log reports.	1
DDM-19	OR-DDM-22	CapTOP shall prevent entry of duplicate work orders for the same problem at the same location.	1
DDM-27, DDM-30, DDM-31	OR-DDM-23	CapTOP shall facilitate direct information exchange between the TMC Operator and Maintenance Staff to share information with regard to device problems, device repair status, maintenance activity status, and work order status.	1
DDM-26	OR-DDM-24	CapTOP shall provide an interface to receive and display CCTV images from traffic.com.	1
DDM-38	OR-DDM-25	CapTOP shall be able to remotely locate and record portable DMS locations via GPS.	1
DDM-39	OR-DDM-26	CapTOP shall track status of maintenance trucks, individuals and teams/shifts during emergencies.	1
DDM-39	OR-DDM-27	CapTOP shall log status changes of maintenance trucks and maintenance teams during emergencies.	1
DDM-4	OR-DDM-28	CapTOP shall provide an interface with Signal Maintenance Contractor's Traffic Information Management System (TIMS) to display data downloaded from the TIMS system.	1
DDM-40	OR-DDM-29	CapTOP shall be able to track maintenance activity, by asset, and by activity, for performance and budget purposes.	1
DDM-9	OR-DDM-30	CapTOP shall provide the TMC Operator or the Maintenance Technician with functions to query the following information on ITS devices and equipment: a. model number; b. date purchased; c. serial number; d. original equipment manufacturer name, address, phone number, web address; e. seller's name, address, phone number, web address; f. warranty information; f. repair history.	1

Source	ID	Requirement Description	Priority
DDM-7	OR-DDM-31	CapTOP shall be able to track and accommodate diagnostics for the following types of communication links: a. DSL circuits; b. twisted pair circuits; c. fiber optic links.	2

4.9 Device Operation and Control

The CapTOP device operational and control requirements are described in TABLE 13 below.

TABLE 13 Device Operational and Control Requirements

Source	ID	Requirement Description	Priority
DOC-1, DOC-10, DOC-11	OR-DOC-1	CapTOP shall be able to monitor the following signals and ITS devices by polling them to determine their operational status: a. 170E-based traffic signals (via QuicNet); b. 2070-based traffic signals (via the future Traffic Signal System); c. CCTV cameras; d. DMS; e. PDMS; f. HAR; g. RWIS; h. detectors/sensors; i. WIM stations; j. vehicle detection/permanent count stations.	1
DOC-1, DOC-10, DOC-11	OR-DOC-2	CapTOP shall allow the polling interval to be configurable per subsystem by the System Administrator.	1
DOC-1, DOC-10, DOC-11	OR-DOC-3	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1

Source	ID	Requirement Description	Priority
DOC-15	OR-DOC-4	CapTOP shall produce reports that list the location and status of the following signals and ITS devices: a. 170E-based traffic signals (via QuicNet); b. 2070-based traffic signals (via the future Traffic Signal System); c. CCTV cameras; d. DMS; e. PDMS; f. HAR; g. RWIS; h. detectors/sensors; i. WIM stations; j. vehicle detection/permanent count stations.	1
DOC-15	OR-DOC-5	CapTOP shall produce reports for any ITS device that has a command pending in the schedule/future event queue.	1
SIG-1, SIG-3	OR-DOC-6	CapTOP shall provide the TMC Operator an interface with QuicNet to be able to monitor the following for all 170E traffic signals in the District of Columbia: a. phase display; b. real-time plan data; c. controller reported alarms; d. controller reported faults.	1
SIG-1, SIG-3	OR-DOC-7	CapTOP shall provide the TMC Operator an interface with the future Traffic Signal System, to be able to monitor the following for all 2070 traffic signals in the District of Columbia: a. phase display; b. real-time plan data; c. controller reported alarms; d. controller reported faults.	1
DOC-6	OR-DOC-8	CapTOP shall maintain a library of pre-defined lists of devices required to support incident and special event management.	1
DOC-13	OR-DOC-9	CapTOP shall provide a report capability to retrieve all operator actions/commands from the log that are part of an incident response.	1
DOC-14	OR-DOC-10	CapTOP shall allow the operator to obtain the status of any camera, subject to operator privilege level.	1

Source	ID	Requirement Description	Priority
DOC-14	OR-DOC-11	CapTOP shall allow the operator to issue the following commands to any camera, subject to operator privilege level: a. pan; b. tilt; c. zoom; d. open iris; e. close iris; f. enable auto iris; g. disable auto iris; h. focus near; i. focus far; j. enable auto focus; k. disable auto focus; l. increase pan speed; m. decrease pan speed; n. increase tilt speed; o. decrease tilt speed; p. enable auxiliary function; q. disable auxiliary function.	1
DOC-14	OR-DOC-12	CapTOP shall allow at least 8 presets to be created by the TMC Operator, subject to privilege level, for each camera and to be executed manually and according to a schedule.	1
DOC-14	OR-DOC-13	CapTOP shall allow tours to be created by the TMC Operator, subject to privilege level, and to be executed manually and according to a schedule.	1
DOC-23	OR-DOC-14	CapTOP shall be able to define and schedule camera tours to monitor the following traffic operations: a. morning rush hour; b. afternoon rush hour; c. special events.	1
DOC-19	OR-DOC-15	CapTOP shall allow the operator to obtain the status of any DMS and PDMS, subject to operator privilege level.	1
TID-9	OR-DOC-16	CapTOP shall allow the TMC Operator to view current messages on any DMS/PDMS.	1
DOC-19	OR-DOC-17	CapTOP shall allow the operator to issue the following commands to any DMS and PDMS subject to operator privilege level: a. display message; b. blank message; c. display diagnostic message;	1
DOC-19	OR-DOC-18	CapTOP shall allow a DMS and PDMS message to be created by the operator, subject to privilege level.	1

Source	ID	Requirement Description	Priority
DOC-19	OR-DOC-19	CapTOP shall allow a DMS and PDMS message to be edited by the operator, subject to privilege level.	1
DOC-19	OR-DOC-20	CapTOP shall allow a DMS and PDMS message to be deleted by the operator, subject to privilege level.	1
TID-17, TID-12, TID-14, TID-8	OR-DOC-21	CapTOP shall provide the TMC Operator the ability to select DMS/PDMS messages from the library of messages, subject to privilege level, based on the following: a. type of DMS/PDMS; b. location of DMS/PDMS; c. type of incident; d. type of special event; e. severity of incident; f. size of special event.	1
DOC-19	OR-DOC-22	CapTOP shall allow the Operator to transmit a message to DMS and PDMS manually and according to a schedule.	1
DOC-19	OR-DOC-23	CapTOP shall allow the operator to obtain the status of any HAR, subject to operator privilege level.	1
TID-9	OR-DOC-24	CapTOP shall allow the TMC Operator to listen to current messages on any HAR.	1
DOC-19	OR-DOC-25	CapTOP shall allow the operator to issue the following commands to any HAR, subject to operator privilege level: a. play message; b. blank message; c. play diagnostic message.	1
DOC-19	OR-DOC-26	CapTOP shall allow an HAR message to be created by the operator, subject to privilege level.	1
DOC-19	OR-DOC-27	CapTOP shall allow an HAR message to be edited by the operator, subject to privilege level.	1
DOC-19	OR-DOC-28	CapTOP shall allow an HAR message to be deleted by the operator, subject to privilege level.	1
TID-17, TID-12, TID-14, TID-6	OR-DOC-29	CapTOP shall provide the TMC Operator the ability to select HAR messages from the library of messages, subject to privilege level, based on the following: a. type of HAR; b. location of HAR; c. type of incident; d. type of special event; e. severity of incident; f. size of special event.	1
DOC-19, TID-13, TID-6	OR-DOC-30	CapTOP shall allow the Operator to transmit a message to HAR manually and according to a schedule.	1

Source	ID	Requirement Description	Priority
DOC-19, TIM-11, TID-15, TID-6	OR-DOC-31	CapTOP shall generate alarms to remind the TMC Operator to change DMS, PDMS, and HAR messages at the following times: a. at non-recurring scheduled date/time; b. at a recurring scheduled date/time; c. in response to a change in incident status; d. after the expiration of a specified duration.	1
DOC-25	OR-DOC-32	CapTOP shall be able to schedule recurring and non-recurring messages to be posted on the following devices: a. HAR; b. DMS; c. PDMS.	1
DOC-25	OR-DOC-33	CapTOP shall be able to confirm messages have been properly transmitted to the following devices: a. HAR; b. DMS; c. PDMS.	1
DOC-4	OR-DOC-34	CapTOP shall allow the TMC Manager to establish priorities for PDMS usage.	1
DOC-7	OR-DOC-35	CapTOP shall allow the TMC Operator to issue electronic work order requests to staff responsible for moving PDMS.	1
DOC-12	OR-DOC-36	CapTOP shall provide the TMC Operator the ability to transmit notifications to contact persons at utility companies to report power failures.	2
DOC-16	OR-DOC-37	CapTOP shall support centralized HAR, DMS, and PDMS control for coordinating regional emergency evacuation.	2
SIG-2	OR-DOC-38	CapTOP shall be able to receive and track the operational status of transit signal priority via QuicNet and the future Traffic Signal System.	2

4.10 Data Warehousing and Archiving

The CapTOP data warehousing and archiving operational requirements are described in TABLE 14.

TABLE 14 Data Warehousing and Archival Operational Requirements

Source	ID	Requirement Description	Priority
DWA-10	OR-DWA-1	CapTOP shall integrate a common GIS mapping system and an enterprise database management system for storing the following traffic management data: a. data collected from ITS field devices; b. incident information; c. device location data; d. TMC operator activities; e. response plans; f. traffic signal plans; g. device configuration information; h. traffic condition data; i. system logs.	1
ConOps 1.3	OR-DWA-2	The CapTOP database management system shall support multiple users, SQL and ANSI database standards, and shall have the ability to support data archiving, database backups, and database diagnostics.	1
DWA-15	OR-DWA-3	CapTOP shall be able to merge/integrate and interpret information from multiple sources, and prompt the operator as required.	1
DWA-3, RTC-16	OR-DWA-4	The GIS spatial data used in the CapTOP street network for DC shall conform to DDOT's GIS standards to allow for seamless information exchange with citywide spatial databases.	1
DWA-11	OR-DWA-5	CapTOP shall maintain a database storing incidents involving the following non-DC agencies: a. WASA; b. Verizon; c. CSX; d. PEPCO.	1

Source	ID	Requirement Description	Priority
DWA-12, DWA-13, PM-2, PM-3, PM-5	OR-DWA-6	CapTOP shall be able to produce the following performance reports based on archived data for evaluating the performance of the system: a. number of incidents over a specified time period; b. number of special events over a specified time period; c. type of incidents over a specified time period; d. type of special events over a specified time period; e. duration of an incident; f. duration of a special event; g. average duration of incident type; h. average duration of special event type; i. number of ROPs required per incident; j. number of ROPS required per special event; k. number of DMS required per incident; l. number of DMS required per special event; m. number of PDMS required per incident; n. number of PDMS required per special event; o. type and quantity of field equipment used for each incident; p. type and quantity of field equipment used for each special event; q. number of DDOT field technicians used for each incident; r. number of DDOT field technicians used for each special event; s. number of DDOT staff hours used for each incident; t. number of DDOT staff hours used for each special event; u. number of attendees at each special event; v. number of transit riders at each special event; w. number of cones used for traffic management; x. traffic volumes by hour by day by road; y. WIM vehicles by hour by day by road.	1

Source	ID	Requirement Description	Priority
DWA-12, DWA-13, PM-2, PM-3, PM-5	OR-DWA-7	CapTOP shall be able to produce the following performance reports based on archived data for evaluating the performance of the operators: a. number of incidents managed by an Operator over a specified time period; b. number of special events managed by an Operator over a specified time period; c. number of Operator commands to DMS over a specified time period; d. number of Operator commands to PDMS over a specified time period; e. number of Operator commands to HAR over a specified time period; f. number of Operator commands to CCTV over a specified time period; g. number of times an Operator logged in over a specified time period; h. number of times an Operator logged out over a specified time period; i. number of Operator commands to traffic signals over a specified time period.	1
DWA-4, DWA-5, DWA-8	OR-DWA-8	CapTOP shall provide a secured data archive to archive the following information: a. traffic volumes from count stations; b. traffic volumes from detector stations; c. weights from WIM stations; d. system event log; e. operator event log; f. incident information; g. special event information.	1
DWA-4, DWA-5, DWA-8	OR-DWA-9	CapTOP shall allow operators, with appropriate privilege levels, to retrieve data from the archive.	1
DWA-6, DWA-12, DWA-13	OR-DWA-10	CapTOP shall be able to generate the following customized reports: a. list of system events sorted by date/time; b. a report showing the measures of effectiveness (MOEs) over a specified time period; c. list of field device status sorted by subsystem then status; d. the number of failed communications sorted by subsystem over a specified time period.	1

Source	ID	Requirement Description	Priority
DWA-7	OR-DWA-11	CapTOP shall provide the ability to capture the following information needed to support a comprehensive log of activities for each event/incident in the system: a. phone calls made; b. incident detection source; c. incident location; d. incident type; e. incident severity; f. verification time; g. clearance time; h. other agencies notified; i. control actions to DMS; j. control actions to PDMS; k. control actions to HAR; l. control actions to Traffic Signals.	1
ConOps 5.1.2	OR-DWA-12	CapTOP shall provide a web-based interface to allow users to conduct online data analysis from the data archive.	1
ConOps 5.1.2	OR-DWA-13	CapTOP shall provide a web-based interface to allow TMC Operators to generate reports from the online archive.	1
DWA-9	OR-DWA-14	CapTOP shall be able to automatically log the receipt of alerts and notifications from the following outside sources: a. CHART; b. NOVA OpenTMS; c. MWCOG; d. RITIS; e. DDOT CIPS; f. DDOT Snow Operations; g. DC UCC; h. DC Public Safety; i. NCR Emergency Response; j. CAPWIN; k. WASA; l. NAWAS; m. WMATA.	1, items a and b are priority 3

4.11 Emergency Management

The CapTOP emergency management operational requirements are described in TABLE 15 below.

TABLE 15 Emergency Management Operational Requirements

Source	ID	Requirement Description	Priority
EM-1, EM-3, EM-4	OR-EM-1	CapTOP shall provide an electronic interface with the EMA to exchange evacuation information and display evacuation routes on the CapTOP map display.	1
RTC-19	OR-EM-2	CapTOP shall provide an electronic interface with the EMA to implement traffic control strategies to support evacuation plans, changes in traffic patterns for special events, and weather-based incidents.	1
EM-1, EM-4	OR-EM-3	CapTOP shall provide an interface with the EMA to receive the following information from emergency management responders: a. location; b. type of incident; c. severity of incident; d. incident duration.	1
EM-5	OR-EM-4	CapTOP shall be able to send video images to emergency management responders and other dispatch centers to aid with dispatch.	1
EM-8	OR-EM-5	CapTOP shall provide the following information to EMA to support emergency operations: a. incidents; b. congested areas; c. special events; d. signal status; e. ITS device status; f. live video; g. road closures; h. lane closures; i. construction zones; j. maintenance operations; k. traffic condition data; l. weather-related road conditions; m. weather-related warnings; n. weather-related closures.	1
EM-9	OR-EM-6	CapTOP shall provide the TMC Operator with a map-based display to monitor reversible lanes and signal status during evacuations.	1
EM-9	OR-EM-7	CapTOP shall provide the TMC Operator with a map-based display to indicate which routes are operating in a reverse direction.	1
EM-9	OR-EM-8	CapTOP shall provide the TMC Operator with a map-based display to indicate which signals are in flash-mode and which are in non-flash mode.	1
EM-2	OR-EM-9	CapTOP shall provide an interface with the Public Emergency Notification System to receive emergency announcements/alerts.	2

Source	ID	Requirement Description	Priority
EM-6, EM-7	OR-EM-10	CapTOP shall be able to disseminate real-time emergency evacuation information to the public and other agencies to support emergency response and evacuation coordination.	2

4.12 Incident Management

The CapTOP incident management operational requirements are described in TABLE 16.

TABLE 16 Incident Management Operational Requirements

Source	ID	Requirement Description	Priority
IM-63, ROP-8	OR-IM-1	CapTOP shall provide an interface to receive and display incident alerts from the following external sources: a. ROP electronic incident notification; c. CIP electronic incident notification; d. 911/Netviewer electronic incident notification; e. RITIS electronic incident notification; f. incidents received electronically from the NOVA OpenTMS; g. incidents received electronically from CHART.	1, items f and g are priority 3
IM-50	OR-IM-2	CapTOP shall be able to receive incident notifications from external sources with GPS longitude/latitude and to display it on the CapTOP map display.	1
IM-19, IM-63	OR-IM-3	CapTOP shall allow the TMC Operator to manually record incident information received via the following methods: a. by viewing CCTV images; b. Citizen phone call; c. ROP phone call; d. MPD phone call; e. police radio.	1

Source	ID	Requirement Description	Priority
IM-39, DWA-11	OR-IM-4	CapTOP shall provide the TMC Operator with a data entry form to record the following incident information in the CapTOP incident database: a. incident ID; b. incident name; c. incident status; d. incident location; e. quadrant; f. ward; g. incident description; h. detection time (n/a for special events); i. incident start date/time; j. incident end date/time; k. number of DDOT employees involved; l. traffic management plan; m. number of signs used; n. number of cones required; o. transit options available; p. traffic routes available; q. the type and quantity of equipment used; r. road name; s. direction; t. exit number; u. milepost; v. interchange; w. address/block; x. source of incident; y. contact information of source (if applicable); z. lanes blocked; za. number of vehicles involved. zb. personal injuries; zc. number of fatalities; zd. property damage; ze. weather conditions; zf. traffic conditions; zg. agencies notified. zh. agencies involved; zi. incident commander; zj. recorded in CAPWIN; zk. TMC operators; zl. event sponsor (special events only); zm. comments.	1
IM-45	OR-IM-5	CapTOP shall provide users a map-based display to geocode incident locations on the GIS map.	1
IM-3	OR-IM-6	CapTOP shall provide the TMC Operator a data-entry interface incorporating error and range checking into all data entry fields.	1

Source	ID	Requirement Description	Priority
IM-14	OR-IM-7	CapTOP shall ensure that required information about incidents is entered at the time incidents are created.	1
IM-3	OR-IM-8	CapTOP shall provide the TMC Operator with error messages to allow for correcting any improper entry of incident data.	1
IM-39	OR-IM-9	For traffic incident notifications received electronically from remote systems, CapTOP shall pre-populate the following fields for the TMC Operator: a. incident status; b. detection time; c. road name; d. direction; e. source of detection.	1
IM-3	OR-IM-10	CapTOP shall allow the TMC Operator to manually input and modify incident data using the map display and pull-down menus via data-entry interfaces.	1
IM-40	OR-IM-11	CapTOP shall support a common format for receiving, storing, and retrieving incident information regardless of the source of the information.	1
IM-58	OR-IM-12	CapTOP shall identify cameras close to the incident, where possible, and route video to a default display for TMC Operator viewing to confirm the incident.	1
IM-58	OR-IM-13	CapTOP shall provide the TMC Operators with CCTV camera controls to pan/tilt/zoom/focus cameras to verify the incident, assess the nature of the incident, and to effectively communicate traffic information to other agencies.	1
IM-39	OR-IM-14	CapTOP shall be able to classify incidents based on the incident location, type, and severity.	1
IM-39	OR-IM-15	CapTOP shall have the ability to automatically retrieve the most appropriate response plan based on the TMC Operator's classification.	1
IM-26, IM-71, SEPM-17	OR-IM-16	Once an incident or special event has been verified by the operator, the location confirmed, and a type and severity assigned by the Operator, CapTOP shall prompt the operator with a pre-defined and step-by-step response plan.	1
IM-27	OR-IM-17	CapTOP shall provide the operator a tool to implement the response plan.	1
SEPM-22, SEPM-23	OR-IM-18	CapTOP shall be able to recall response plans based on knowledge-based and rule-based databases, and, to retrieve pre-defined response plan for incidents and special events based on the type of incident/special event, location, and severity.	1

Source	ID	Requirement Description	Priority
IM-26, IM-72, SEPM-17	OR-IM-19	The CapTOP incident response plan shall consist of the following: a. messages that should be played on HAR; b. messages that should be displayed on DMS/PDMS; c. alternative route information; d. recommended signal timing plan changes; e. recommended ROP dispatches; f. graphical maps to illustrate traffic impacts; g. notifications, with content and communication medium clearly defined, that needs to be transmitted to other agencies and stakeholders; h. location of barriers/cones (special events only); i. parking information (special events only); j. recommended transit usage (special events only).	1
IM-9, IM-72	OR-IM-20	CapTOP shall prioritize the items in the response plan and provide check boxes and comments to ensure each step is implemented, or alternatively to document why it was skipped.	1
IM-52	OR-IM-21	CapTOP shall provide online templates for creating text message alerts and updates for different types of incidents and special events for dissemination to public.	1
IM-52	OR-IM-22	CapTOP shall allow alert message to be sent to PCs, cell phones, Blackberries, and PDAs.	1
IM-13	OR-IM-23	CapTOP shall allow the TMC Operator to disseminate alerts to the public, which contain the details of each incident/event.	1
IM-88	OR-IM-24	CapTOP shall provide tools to allow the TMC Operator to disseminate incident/special event information to media and the press.	1
IM-58	OR-IM-25	CapTOP shall be able to generate and send incident alerts to multiple agencies and individuals via the following formats: a. instant messages; b. email messages (to computers, PDAs, and Blackberry-type devices); c. phone voicemail; d. pager messages; e. web alerts.	1
IM-6	OR-IM-26	CapTOP shall be able to send incident alerts to various stakeholders based on location, road type, time of day, severity, and type.	1
SEPM-1	OR-IM-27	CapTOP shall maintain "notification" distribution list(s) of stakeholders for each type of incident and special event and send electronic updates during incidents and special events when there is a change in status.	1
IM-1	OR-IM-28	CapTOP shall be able to send alert to individuals and distribution lists via the City's existing email system.	2

Source	ID	Requirement Description	Priority
IM-38	OR-IM-29	CapTOP shall log all Operator transmitted alerts.	1
IM-38	OR-IM-30	The CapTOP log shall identify the date, time, operator who generated the alert and message content.	1
IM-7, IM-73	OR-IM-31	CapTOP shall be able to confirm receipt of outgoing alerts and notifications sent electronically to specific distribution lists.	1
IM-18	OR-IM-32	CapTOP shall store templates for different types of alerts that are tailored to different types of incidents and special events.	1
IM-27	OR-IM-33	CapTOP shall provide the TMC Operator an interface to display and track the status of incident activities.	1
IM-24, IM-25	OR-IM-34	CapTOP shall be able to track the operator's activities, track the status of available personnel and equipment resources, and track follow-ups that are needed during incidents.	1
IM-81	OR-IM-35	CapTOP shall be able to process and organize incident/special event data to provide comprehensive reports that address the following incident management phases: a. detection; b. verification; c. response; d. after-the-fact analysis of incident management activities.	1
IM-36	OR-IM-36	CapTOP shall provide reporting tools to generate special event/incident reports and activity reports describing the characteristics and status of events/incidents addressed during each operations shift.	1
IM-37	OR-IM-37	CapTOP shall be able to generate special event/incident reports tailored to the needs of the following stakeholders: a. elected officials; b. supervisors; c. senior management.	1
IM-7, IM-73, IM-74, IM-75	OR-IM-38	CapTOP shall provide the TMC Operator with alerts/reminders to take action at the following times: a. start of incident; b. expected duration updated; c. closure of incident.	1
IM-2	OR-IM-39	CapTOP shall provide periodic reminders to operators after a pre-configured amount of time has expired and if no updates have occurred to open incidents.	1
IM-10	OR-IM-40	CapTOP shall support users at different workstations to work on the same incident in the system, at the same time without conflicts.	1
IM-86	OR-IM-41	CapTOP shall archive all incident/event data to develop, evaluate, and refine strategies and scenarios for different types of events/incidents under different conditions.	1

Source	ID	Requirement Description	Priority
IM-39	OR-IM-42	CapTOP shall provide tools to develop incident response plans based on incident type, severity and location.	1
IM-39	OR-IM-43	CapTOP shall support an interactive development process for response plans with TMC managers permitting editing, reviewing, and baselining each plan.	1
IM-53, IM-80, IM-70	OR-IM-44	CapTOP shall incorporate SOP checklists in response plans and provide the TMC Operator electronic checklists that step through a prioritized list of needed actions as part of the incident response.	1
IM-17	OR-IM-45	CapTOP shall provide a report capability to list open and closed incidents.	1
IM-28	OR-IM-46	CapTOP shall provide alerts to TMC Operators when incident records have remained open for a specified period of time.	1
IM-2	OR-IM-47	CapTOP shall allow the TMC Manager to reassign incidents to other operators in the event that active incidents remain open during shift changes.	1
IM-4, IM-29, IM-44	OR-IM-48	CapTOP shall provide the TMC Operator proper access rights to view contents of incident records currently open by another TMC operator with a "pass over" function to ensure pending items are addressed and critical information is passed on to next shift.	1
IM-20, IM-53, IM-78	OR-IM-49	CapTOP shall provide the TMC Operator access to the following resources: a. contact lists; b. response plans; c. SOPs; d. help functions.	1
IM-34	OR-IM-50	CapTOP shall maintain a stakeholder database that can identify Points of Contact (POCs) for all agencies/organizations involved in traffic incident management and response.	1
IM-8	OR-IM-51	CapTOP shall be able retrieve and display a list of contacts that need to be informed of incidents at certain locations and of certain types.	1
SEPM-60	OR-IM-52	CapTOP shall be able to disseminate the following details about incidents and special events via alerts to specific groups using distribution lists, appropriate for each planned incident and special event: a. location; b. type of event; c. status of event; d. duration of event; e. start time; f. end time.	1
IM-22	OR-IM-53	CapTOP shall be able to identify and prompt the Operator for the removal of empty incident records.	1

Source	ID	Requirement Description	Priority
IM-22	OR-IM-54	CapTOP shall be able to identify and prompt the Operator for the removal of duplicate incident records.	1
IM-33	OR-IM-55	CapTOP shall be able to prompt the Operator to reset ITS devices to their pre-incident/event status when closing an incident/event.	1
IM-33	OR-IM-56	CapTOP shall, upon operator confirmation, implement the following device reset actions: a. blanking a DMS; b. restoring a default message to a DMS; c. blanking a HAR; d. restoring a default message to a HAR; e. returning cameras to their default position/preset.	1
IM-17, IM-35, IM-37, IM-40	OR-IM-57	CapTOP shall be able to query and retrieve incident data by the following criteria: a. incident type; b. incident location.	1
IM-41	OR-IM-58	CapTOP shall log the following incident response activities: a. the command entered by the TMC Operator; b. the operator entering the command; c. the time the command was input.	1
IM-41	OR-IM-59	CapTOP shall prevent log entries from being altered after the fact.	1
IM-54, IM-82, IM-85	OR-IM-60	CapTOP shall provide ROP drivers a remote web-based interface to CapTOP to perform the following: a. view incident status; b. view device status; c. view event logs; d. enter incident information from incident scenes.	1
IM-64, IM-65, IM-66	OR-IM-61	CapTOP shall support incident response coordination between the TMC and the ROP drivers through real-time information exchange.	1
IM-67, ROP-14	OR-IM-62	CapTOP shall provide an interface to receive and display mobile video images from wireless portable CCTV cameras used by ROP operators.	1
IM-65, IM-68	OR-IM-63	CapTOP shall be able to track and display the current location of ROP vehicles, equipped with AVL at all times.	1
IM-45	OR-IM-64	CapTOP shall provide users the ability to search for incident locations by street address and intersection.	1
IM-12, IM-47	OR-IM-65	CapTOP shall provide a map-based display to show the location and status of current incidents on the street networks and freeways.	1
IM-12, IM-47	OR-IM-66	CapTOP shall provide a map-based display to show information from other agencies through the use of colors, icons, and labels.	1

Source	ID	Requirement Description	Priority
IM-61, IM-62	OR-IM-67	CapTOP shall be able to track external agency incident response to support coordination of activities for both planned and unplanned incidents.	1
IM-48	OR-IM-68	CapTOP shall provide a map-based display to show the schedule and status of reversible lanes for monitoring and control purposes during incident.	1
IM-69, IM-83	OR-IM-69	CapTOP shall support Police Amber alerts by permitting Amber alert messages to be displayed on the following: a. DMS; b. PDMS.	2
IM-69, IM-83	OR-IM-70	CapTOP shall support Police Amber alerts by permitting Amber alert messages to be recorded on HAR devices.	2
IM-69, IM-83	OR-IM-71	CapTOP shall support a common code-naming system for incident data records to share with other agencies using a similar data dictionary.	2

4.13 Multi-Modal/Multi-Agency Coordination and Communication

The CapTOP multi-modal/multi-agency operational requirements are described in TABLE 17 below.

TABLE 17 Multi-Modal/Multi-Agency Coordination and Communication Operational Requirements

Source	ID	Requirement Description	Priority
MMC-2	OR-MMC-1	CapTOP shall interface with the DDOT online Emergency Permit Request website to retrieve permit information for utility companies emergency repair requests.	1
MMC-3	OR-MMC-2	CapTOP shall interface with the DDOT permitting office to receive information about permits for lane/road closures due to utility repairs.	1
ConOps 3.3	OR-MMC-3	CapTOP shall provide online training to train TMC Operators, Managers, Maintenance Technicians, and other users that require CapTOP access.	1
MMC-1, MMC-4, MMC-7	OR-MMC-4	CapTOP shall provide the MPD and the Capitol Police with access to the CapTOP system to view the status of roadways, traffic signals, incidents, and devices under the control of Capitol police.	2

Source	ID	Requirement Description	Priority
MMC-1, MMC-4, MMC-7, ConOps 4.1	OR-MMC-5	CapTOP shall display roadway blockages and MPD preempted signals at pop-up barrier/delineator locations.	2
MMC-5, MMC-6	OR-MMC-6	CapTOP shall provide an interface with WMATA to exchange information regarding roadway conditions/incidents/events that may impact WMATA rail operations, bus operations, and transit ridership.	1
IM-46	OR-MMC-7	CapTOP shall provide a map-based display to show up-to-date WMATA bus routes and identify any bus routes that are affected by current incidents.	1
MMC-1, MMC-4, MMC-7	OR-MMC-8	CapTOP shall be able to receive rail alerts from WMATA via an XML interface.	2
MMC-1, MMC-4, MMC-7	OR-MMC-9	CapTOP shall be able to receive bus alerts from WMATA via an XML interface.	2

4.14 Performance Measurement

The CapTOP performance measurement requirements are described in TABLE 18.

TABLE 18 Performance Measurement Requirements

Source	ID	Requirement Description	Priority
PM-10	OR-PM-1	CapTOP shall provide functions to collect, analyze, track, and produce performance measurements of following: a. personnel; b. the system; c. incident response; d. ITS devices.	1
PM-10	OR-PM-2	CapTOP shall provide the ability for the TMC Manager to produce performance reports based on the following inputs: a. time period; b. type of personnel; c. type of incidents; d. type of ITS devices.	1
PM-4	OR-PM-3	CapTOP shall format and generate performance reports to comply with requirements of FHWA performance measures for incident management and traffic management.	1

Source	ID	Requirement Description	Priority
PM-8	OR-PM-4	CapTOP shall be able to create performance reports with the following summary information regarding special events and incidents: a. timeline of all system activity; b. messages to DMS/PDMS; c. messages to HAR; d. call logs; e. operator notes; f. MOE data; g. alerts and notifications sent to other systems. h. alerts and notifications received by other systems.	1
PM-12	OR-PM-5	CapTOP shall produce post-event reports that document the resources used.	1
PM-13	OR-PM-6	CapTOP shall be able to produce performance measure reports at regular intervals from both online and archived data.	1
PM-9, PM-14	OR-PM-7	CapTOP shall be able to monitor and track communications outages, restoration of services, field device operation and malfunction, and device reliability.	1
PM-15	OR-PM-8	CapTOP shall provide a ROP-specific log, unique to each driver, to record the following ROP driver activities: a. miles traveled; b. number and type of incidents responded; c. time spent at each incident.	1
PM-15	OR-PM-9	CapTOP shall provide a function to retrieve the ROP driver activity log by date/time.	1
PM-15	OR-PM-10	CapTOP shall provide a function to retrieve the ROP driver activity log by ROP name.	1

4.15 Roadway Operations Patrol

The CapTOP Roadway Operations Patrol (ROP) operational requirements are described in TABLE 19 below.

TABLE 19 ROP Operational Requirements

Source	ID	Requirement Description	Priority
ROP-11, ROP-12, ROP-13, ROP-23, ROP-16	OR-ROP-1	CapTOP shall provide a data communication interface between TMC operators and ROP drivers, and provide the ability for the ROP driver and TMC operator to log the following: a. time the ROP arrived at a scene; b. incident updates by the ROP drivers; c. time the ROP departed the scene; d. ROP requests for additional assistance/resources.	1
ROP-2, ROP-3, ROP-4, ROP-21	OR-ROP-2	CapTOP shall provide a Computer-Aided Dispatch (CAD) capability with fleet management services to support the following activities: a. dispatch of vehicles; b. tracking of location via AVL; c. status of ROP vehicles (en route, out of service, incident scene, other); d. dynamic incident assignments based on the location of vehicles and incident priorities.	1
ROP-15	OR-ROP-3	CapTOP shall provide a map-based display to show the location and assignment status of ROP resources.	1
ROP-19, ROP-20, ROP-22	OR-ROP-4	CapTOP shall be able to generate a statistical report in regard to ROP operations over a user-specified time interval.	1
ROP-5, ROP-6, ROP-7, ROP-9	OR-ROP-5	CapTOP shall be able to generate reports to document the following: a. status/availability of ROP vehicles; b. number of drivers per shift; c. resources consumed; d. expenditures; e. productivity of ROP units.	1
ROP-1, ROP-10	OR-ROP-6	CapTOP shall provide ROP drivers with remote access from laptop computers, and allow them to "sign in" at field offices when they begin and end their shifts.	1

4.16 Regional Traffic Management Coordination

The CapTOP regional traffic management and coordination operational requirements are described in TABLE 20 below.

TABLE 20 Regional Traffic Management Operational Requirements

Source	ID	Requirement Description	Priority
RTC-2, RTC-8, RTC-9, RTC-10, RTC-12, RTC-15	OR-RTC-1	CapTOP shall provide a standard, generic electronic interface to support integration with other regional systems to share the following traffic information: a. incidents; b. congested areas; c. special events; d. signal status; e. ITS device status; f. live video; g. road closures; h. lane closures; i. construction zones; j. maintenance operations; k. traffic condition data; l. weather-related road conditions; m. weather-related warnings; n. weather-related closures.	1
RTC-13	OR-RTC-2	CapTOP shall provide electronic interfaces with the NOVA OpenTMS to exchange the following information: a. DMS status; b. Incident information; c. Road condition information; d. Road closure information; e. Road weather information; f. Video.	3
RTC-13	OR-RTC-3	CapTOP shall provide an electronic interface with the NOVA OpenTMS to request DMS and HAR coordinated messages.	3
RTC-13	OR-RTC-4	CapTOP shall provide electronic interfaces with the SHA's CHART system to exchange the following information. a. DMS status; b. Incident information; c. Road condition information; d. Road closure information; e. Road weather information; f. Video.	3
RTC-13	OR-RTC-5	CapTOP shall provide an electronic interface with the SHA's CHART system to request DMS and HAR coordinated messages.	3

Source	ID	Requirement Description	Priority
RTC-6	OR-RTC-6	CapTOP shall provide the TMC Operator with the following electronic notification tools to request use of **DMSs** in Virginia and Maryland and to receive acknowledgments from the owner: a. e-mail notification; b. message board notification; c. instant message; d. notification using a custom interface.	1
RTC-6	OR-RTC-7	CapTOP shall provide the TMC Operator with the following electronic notification tools to request use of **HARs** in Virginia and Maryland and to receive acknowledgments from the owner: a. e-mail notification; b. message board notification; c. instant message; d. notification using a custom interface.	1
RTC-7	OR-RTC-8	CapTOP shall provide the ability to share video feeds using fixed frame images and video streaming with the following groups: a. event responders; b. external agencies; c. private sector companies.	1
RTC-22	OR-RTC-9	CapTOP shall be able to disseminate traveler information about incidents/special events to roadway users who are approaching DC by cooperating with the following neighboring jurisdictions: a. SHA; b. VDOT.	1
RTC-11	OR-RTC-10	CapTOP shall communicate with CapWIN via RITIS for exchanging traffic/incident information.	1
RTC-21	OR-RTC-11	CapTOP shall provide an online video teleconferencing capability for DDOT personnel during emergencies when they cannot be in the same location.	2
RTC-17	OR-RTC-12	CapTOP shall provide the ability to share video data of the DC Metro area with other DC agencies for traffic and security monitoring purposes.	2
RTC-5	OR-RTC-13	CapTOP shall support integrated regional traffic control coordination on freeways and surface streets in VA, MD, and DC.	2

Source	ID	Requirement Description	Priority
RTC-24	OR-RTC-14	CapTOP shall be able to share the equipment status from the following devices with external agencies: a. traffic signals; b. CCTV cameras; c. DMS; d. PDMS; e. HAR; f. RWIS; g. detectors/sensors; h. WIM stations; i. vehicle detection/permanent count stations.	2
RTC-24	OR-RTC-15	CapTOP shall be able to share the following equipment status states with external agencies: a. on-line; b. on-line and message display (DMS/HAR only); c. device failure; d. communication failure.	2

4.17 Special Event Planning and Management

The CapTOP special event planning and management operational requirements are described in TABLE 21 below.

TABLE 21 Special Event Planning and Management Operational Requirements

Source	ID	Requirement Description	Priority
SEPM-8, SEPM-42	OR-SEPM-1	CapTOP shall provide the TMC Operator with a data entry form to record the special event information in the CapTOP special event database:	1
SEPM-5, SEPM-47, SEPM-48, SEPM-49, SEPM-50, SEPM-51, SEPM-52, SEPM-53	OR-SEPM-2	CapTOP shall provide a map-based display to show the following special event information that affects the transportation system: a. road closures; b. routes impacted by the special event; c. parking restrictions; d. ITS device/signals used for the special events.	1
SEPM-34	OR-SEPM-3	CapTOP shall provide DDOT staff with functions to track personnel activities and generate reports related to personnel activities and costs associated with supporting special events.	1

Source	ID	Requirement Description	Priority
SEPM-35, SEPM-36, SEPM-38, SEPM-43, SEPM-45	OR-SEPM-4	CapTOP shall archive the following information related to special events: a. traffic demand/condition data; b. operator actions during special events; c. traffic control plans for special events.	1
SEPM-25	OR-SEPM-5	CapTOP shall provide the TMS Operator with a list of special events, planned and underway, when their shift begins.	1
SEPM-25	OR-SEPM-6	CapTOP shall display the active special events on a GIS map when requested by the TMC Operator.	1
SEPM-4, SEPM-41, SEPM-44, SEPM-61	OR-SEPM-7	CapTOP shall log the following TMC actions/activity associated with special events: a. date/time; b. operator responsible for the action; c. action taken; d. resources used; e. staff involved in the action.	1
SEPM-2, SEPM-3	OR-SEPM-8	CapTOP shall provide a function to estimate and track staff and equipment resources needed to support special event traffic management.	1
SEPM-3, SEPM-29	OR-SEPM-9	CapTOP shall be able to track, query, and identify the status and location of personnel and equipment needed for special event operations via the asset management system.	1
SEPM-64	OR-SEPM-10	CapTOP shall provide a map-based display to monitor the use of traffic control strategies involving lane controls, reversible lanes, and turning restrictions during special events.	1
SEPM-63	OR-SEPM-11	CapTOP shall disseminate traffic information during special events to the public using the following methods: a. HAR; b. DMS; c. PDMS; d. Web.	1
SEPM-54, SEPM-55, SEPM-56	OR-SEPM-12	CapTOP shall provide a web-based interface to allow TMC Operators or authorized Guests, at remote locations, to access the following details about special events: a. location; b. type of event; c. duration of event; d. start time; e. end time; f. DMS/HAR messages; g. traffic control plans.	1

Source	ID	Requirement Description	Priority
SEPM-58	OR-SEPM-13	CapTOP shall provide an interface with MPD's Mobile Command Unit to exchange updates on special event status, and to track the Unit's location.	1
SEPM-30, SEPM-31	OR-SEPM-14	CapTOP shall be identify and automatically locate traffic signals and ITS devices that could be used to manage the event.	1
SEPM-33	OR-SEPM-15	CapTOP shall be able to generate a post-event report with the following information: a. number of attendees; b. traffic impacts; c. event duration.	1
SEPM-10	OR-SEPM-16	CapTOP shall allow the TMC Operator to create and update traffic event messages for HAR, DMS, PDMS before, during, and at the end of each special event.	1
SEPM-11	OR-SEPM-17	CapTOP shall maintain a comprehensive Point of Contact (POC) list for each event that identifies the organizers, contacts at event venue, and individuals in various DC agencies.	1
SEPM-11	OR-SEPM-18	The CapTOP Special Event POC list shall consist of the following fields: a. the name of each POC; b. POC agency; c. POC title; d. POC address; e. POC e-mail address; f. POC phone number.	1
SEPM-12	OR-SEPM-19	CapTOP shall maintain a library of response plans that can be selected from a menu, for different types of events at different locations.	1
SEPM-13	OR-SEPM-20	CapTOP shall provide the TMC Operator with the capability to create approved special event records with information about planned (future) events that have been approved by Mayor's committee.	1
SEPM-13	OR-SEPM-21	CapTOP shall provide reminders to TMC Operator at a configurable number of minutes prior to the event start.	1
SEPM-13	OR-SEPM-22	CapTOP shall provide response plan reminders to TMC Operators at a configurable number of minutes prior to the event start.	1
SEPM-14	OR-SEPM-23	CapTOP shall support traffic engineers in developing, evaluating, and implementing special signal timing plans for special events.	2

Source	ID	Requirement Description	Priority
SEPM-16	OR-SEPM-24	CapTOP shall provide the TMC Operator a map-based display to identify the following devices that must be checked frequently during a special event: a. traffic signals; b. CCTV cameras; c. DMS; d. PDMS; e. HAR.	2
SEPM-20	OR-SEPM-25	CapTOP shall provide a database and record the following information about special events: a. name of event; b. type of event; c. key contacts; d. traffic management strategy; e. setup time; f. event start time; g. event end time.	1
SEPM-21	OR-SEPM-26	CapTOP shall store and pull up staffing assignments and point of contact lists for planned special events.	1
SEPM-27	OR-SEPM-27	CapTOP shall be able to receive the following real-time transit information from WMATA for special events: a. bus routes; b. bus locations; c. passenger demand.	2
SEPM-59	OR-SEPM-28	CapTOP shall provide an interface with WMATA to exchange information about bus ingress and egress routes during special events.	2
SEPM-27	OR-SEPM-29	CapTOP shall be able to disseminate the following real-time transit information at special event locations using HAR, DMS, and PDMS: a. bus routes; b. bus locations.	2
SEPM-28	OR-SEPM-30	CapTOP shall be able to retrieve and display up-to-date information about the location and status of PDMSs and DMSs operated by NOVA's OpenTMS and SHA's CHART systems that provide information for drivers destined for the city.	1

4.18 Software Management and Maintenance

The CapTOP software management and maintenance operational requirements are described in TABLE 22 below.

TABLE 22 Software Management and Maintenance Operational Requirements

Source	ID	Requirement Description	Priority
SMM-1	OR-SMM-1	CapTOP shall provide the ability for the System Administrator to create, modify or delete user accounts.	1
SMM-1	OR-SMM-2	CapTOP shall provide the ability for the System Administrator to create, modify or delete groups.	1
SMM-1	OR-SMM-3	CapTOP shall allow each user to be assigned by the System Administrator to one or more of the following groups: a. External User; b. Maintenance Manager; c. Maintenance Technician; d. ROP Driver; e. ROP Manager; f. System Administrator; g. TMC Manager; h. TMC Operator; i. Transportation Planner; j. Traffic Engineer.	1
SMM-1	OR-SMM-4	CapTOP shall allow the System Administrator to add, modify, delete individuals from the group membership without having to modify individual accounts.	1
SMM-1	OR-SMM-5	CapTOP shall provide role-based privileges for each group, and allow each group to be configured by the System Administrator to be able to do the following: a. subscribe to receive events and alarms on a per subsystem basis; b. gain access to all live or recorded video; c. control cameras; d. view video; e. view the status of all ITS devices; f. view the status of traffic signals; g. access the Traffic Signal Control 170E System; h. access the Traffic Signal Control 2070 System; i. control DMS/PDMS; j. control HAR; k. control other forms of notification, such as text/e-mail messages and image transmission; l. enable or disable the ability to classify incidents; m. execute incident response plans; n.. to enable or disable the ability to generate reports; n. override controls if a camera is locked; o. override controls if a DMS/PDMS is locked; p. override controls if a HAR is locked; q. access archive data; r. gain access to system administration functions in the system.	1

Source	ID	Requirement Description	Priority
SMM-1	OR-SMM-6	CapTOP shall allow the System Administrator to override, at the account-level, any privileges assigned at the group-level.	1
SMM-1	OR-SMM-7	CapTOP shall provide the System Administrator access to all system functions.	1
SMM-1	OR-SMM-8	CapTOP shall provide access control functions to restrict user access by subsystem.	1
SMM-13	OR-SMM-9	CapTOP shall support data integrity using the following methods: a. authenticating that data is received from valid sources; b. ensuring permission classes and user privileges are adhered to without exception.	1
SMM-5	OR-SMM-10	CapTOP shall incorporate the following features to minimize the probability and impact of failures: a. workstation redundancy; b. server redundancy; c. database redundancy; d. backups of system data; e. limited function/data access; f. lockout of functions/data access, subject to privilege level; g. information blocking on operator request, subject to privilege level; h. sensitive video blocking on operator request, subject to privilege level.	1
SMM-5	OR-SMM-11	CapTOP shall document all system activities as it relates to the following: a. system upgrades; b. system configuration changes; c. troubleshooting; d. general maintenance.	1

4.19 System Design and Functions

Refer to the requirements in Section 2.

4.20 Traffic Data Collection and Analysis

The CapTOP traffic data collection and analysis operational requirements are described in TABLE 23 below.

TABLE 23 Traffic Data Collection and Analysis Operational Requirements

Source	ID	Requirement Description	Priority
TDCA-3	OR-TDCA-1	CapTOP shall provide an interface with all vehicle detection stations to retrieve traffic speed, volume, and occupancy data.	1
TDCA-3	OR-TDCA-2	CapTOP shall be able to store aggregated vehicle detection station speed, volume, and occupancy data in the CapTOP database, at a user specified interval, between 1 minute and 24 hours.	1
TDCA-3	OR-TDCA-3	CapTOP shall store the vehicle detection station data by road name and interchange.	1
TDCA-3	OR-TDCA-4	CapTOP shall display data from vehicle detection stations in both tabular and graphical formats.	1
TDCA-3	OR-TDCA-5	CapTOP shall provide an interface with all permanent count stations to retrieve speed, volume, occupancy, and classification data.	1
TDCA-3	OR-TDCA-6	CapTOP shall be able to store aggregated speed, volume, occupancy, and classification data from permanent count stations in the CapTOP database, at a user specified interval, between 1 minute and 24 hours.	1
TDCA-3	OR-TDCA-7	CapTOP shall store the speed, volume, occupancy, and classification data by road name and interchange.	1
TDCA-3	OR-TDCA-8	CapTOP shall display data from permanent count stations in both tabular and graphical formats.	1
TDCA-4	OR-TDCA-9	CapTOP shall provide a web-based interface with the SpeedInfo data server to retrieve speed, volume, and occupancy data every 15 seconds using an XML interface.	1
TDCA-3	OR-TDCA-10	CapTOP shall be able to store SpeedInfo speed, volume, and occupancy data in the CapTOP database.	1
TDCA-3	OR-TDCA-11	CapTOP shall display data from SpeedInfo in both tabular and graphical formats.	1
TDCA-5	OR-TDCA-12	CapTOP shall provide a web-based interface with Traffic.com to retrieve speed, volume, and occupancy data.	1
TDCA-3	OR-TDCA-13	CapTOP shall be able to store Traffic.com speed, volume, and occupancy data in the CapTOP database.	1
TDCA-3	OR-TDCA-14	CapTOP shall display data from Traffic.com in both tabular and graphical formats.	1
TDCA-1	OR-TDCA-15	CapTOP shall collect and format traffic and incident data for direct use in DDOT's current traffic simulation/analysis application (currently Synchro).	2

Source	ID	Requirement Description	Priority
TDCA-2	OR-TDCA-16	CapTOP shall be able to **retrieve and display** configuration data from the following devices: a. 170E-based traffic signals (monitoring only via QuicNet); b. 2070-based traffic signals (monitoring only via the future Traffic Signal System); c. CCTV cameras; d. DMS; e. PDMS; f. HAR; g. RWIS; h. detectors/sensors; i. WIM stations; j. vehicle detection/permanent count stations.	1
TDCA-2	OR-TDCA-17	CapTOP shall be able to **store** configuration in the CapTOP central system for the following devices: a. 170E-based traffic signals (monitoring only via QuicNet); b. 2070-based traffic signals (monitoring only via the future Traffic Signal System); c. CCTV cameras; d. DMS; e. PDMS; f. HAR; g. RWIS; h. detectors/sensors; i. WIM stations; j. vehicle detection/permanent count stations.	1
TDCA-2	OR-TDCA-18	CapTOP shall be able to **download** configuration from the CapTOP central system to the following devices: a. 170E-based traffic signals (monitoring only via QuicNet); b. 2070-based traffic signals (monitoring only via the future Traffic Signal System); c. CCTV cameras; d. DMS; e. PDMS; f. HAR; g. RWIS; h. detectors/sensors; i. WIM stations; j. vehicle detection/permanent count stations.	1

4.21 Traveler Information Dissemination

The CapTOP traveler information dissemination operational requirements are described in TABLE 24 below.

TABLE 24 Traveler Information Dissemination Operational Requirements

Source	ID	Requirement Description	Priority
TID-1	OR-TID-1	CapTOP shall be able to alert other agencies and media of the following: a. incidents; b. weather conditions; c. emergencies; d. other events affecting roadway operations.	1
TID-10	OR-TID-2	CapTOP shall allow the TMC Operator to view and verify the current message a DMS and PDMS via the CapTOP map-based display.	1
TID-18	OR-TID-3	CapTOP shall provide support to check the consistency of messages posted on DMS, PDMS, and HAR in DC, MD and VA for regional traffic management.	1
TID-2	OR-TID-4	CapTOP shall provide the ability to compute travel time information and display on DMS and PDMS.	1
TID-4, TID-7	OR-TID-5	CapTOP shall disseminate tailored traveler information to the following groups of travelers: a. travelers within DC; b. travelers who are passing through DC; c. travelers with either an origin or destination in DC and traveling to, from (or through) MD and VA.	1
TID-3	OR-TID-6	CapTOP shall be able to post information about the following activities on web pages, DMSs, PDMSs, and HARs: a. road closures; b. congestion; c. accidents; d. special events; e. construction zones; f. maintenance operations; g. Police emergencies.	2

Source	ID	Requirement Description	Priority
TID-5	OR-TID-7	CapTOP shall be able to distribute traffic information to the following agencies/partners involved in traffic management: a. CHART; b. NOVA OpenTMS; c. RITIS; d. DDOT Snow Operations; e. DC UCC; f. DC Public Safety; g. NCR Emergency Response; h. CAPWIN; i. WMATA.	2, items a and b are priority 3

4.22 Traffic Operations and Management

The CapTOP traffic operations and management operational requirements are described in TABLE 25 below.

TABLE 25 Traffic Operations and Management Operational Requirements

Source	ID	Requirement Description	Priority
TOM-2	OR-TOM-1	CapTOP shall produce TMC activity reports based on logged daily activity data.	1
TOM-4, TOM-8	OR-TOM-2	CapTOP shall provide the TMC Operator access to the following database information: a. incidents; b. congested areas; c. special events; d. road closures; e. lane closures; f. construction zones; g. signal status; h. ITS device status; i. maintenance operations; j. traffic condition data; k. weather-related road conditions; l. weather-related warnings; m. weather-related closures.	1

Source	ID	Requirement Description	Priority
TOM-9	OR-TOM-3	CapTOP shall provide interfaces to coordinate with its regional counterparts regarding traffic-signal timing and overall surface-street strategies to ensure the safe and efficient movement of vehicular movements across jurisdictional boundaries.	1

4.23 Traffic Signal Monitoring

The CapTOP traffic signal monitoring operational requirements are described in the following sections:

- Refer to requirement SR-SYS-9 and SR-SYS-23 in Section 2.
- Refer to requirement IR-GUI-9, IR-GUI-10, IR-GUI-13, IR-GUI-15, IR-GUI-25, IR-GUI-42, IR-GUI-43, IR-GUI-49, and IR-GUI-50 in Section 3.1.
- Refer to requirement OR-DOC-1, OR-DOC-4, OR-DOC-6, OR-DOC-7, and OR-DOC-8 in Section 4.9.
- Refer to requirement OR-EM-6 and OR-EM-8 in Section 4.11.
- Refer to requirement OR-MMC-4 and OR-MMC-5 in Section 4.13.
- Refer to requirement OR-TDCA-16, OR-TDCA-17, and OR-TDCA-18 in Section 4.20.

4.24 Tunnel Operations and Control

The CapTOP tunnel operations and control requirements are described in TABLE 26 below.

TABLE 26 Tunnel Operations and Control Requirements

Source	ID	Requirement Description	Priority
CIP-6	OR-TOPS-1	CapTOP shall provide an interface with the SCADA system to monitor Carbon Monoxide (CO), drainage, ventilation, and environmental conditions at the 3rd Street and 12th Street Tunnels.	2
CIP-6	OR-TOPS-2	CapTOP shall provide an interface to receive overheight vehicle notifications from the 3rd Street Tunnel SCADA system.	2
CIP-6	OR-TOPS-3	CapTOP shall provide alarms to the user alerting of overheight vehicle detections obtained from the 3rd Street Tunnel SCADA system.	2

4.25 Weather Event Management

The CapTOP weather event management operational requirements are described in TABLE 27 below.

TABLE 27 Weather Event Operational Requirements

Source	ID	Requirement Description	Priority
WEM-1	OR-WEM-1	CapTOP shall provide an interface to retrieve weather data from ScanWeb.	1
WEM-1	OR-WEM-2	CapTOP shall provide a map-based display to show weather data from ScanWeb.	1
WEM-2, WEM-10	OR-WEM-3	CapTOP shall provide an interface to retrieve atmospheric and road weather data from the RWIS.	1
WEM-2, WEM-10	OR-WEM-4	CapTOP shall provide a map-based display to show atmospheric and road weather data from the RWIS.	1
WEM-5	OR-WEM-5	CapTOP shall alert the TMC Operator when temperature conditions, as received from the RWIS, fall below a specified level.	2
WEM-3, WEM-11, WEM-12, WEM-13	OR-WEM-6	CapTOP shall provide an interface with the StormTrak system to retrieve the following: a. regional weather information; b. roadway weather condition information; c. snow operation routes/status.	1
WEM-3, WEM-11, WEM-12, WEM-13	OR-WEM-7	CapTOP shall provide a map-based display to show the data obtained from the StormTrak system.	1
WEM-6	OR-WEM-8	CapTOP shall be able to generate rated roadway surface conditions reports for snow operations every 20–30 minutes, based on video images and weather data from StormTrak and RWIS.	1
WEM-7	OR-WEM-9	CapTOP shall be able to transmit the video clips of roadway condition to the Snow Center for confirming the status of roadways (plowed/not plowed) on request.	1
WEM-9	OR-WEM-10	CapTOP shall be able to display messages related to snow activities on DMS and PDMS during snow events.	2
WEM-9	OR-WEM-11	CapTOP shall be able to play messages related to snow activities on HAR during snow events.	2

5. PERFORMANCE REQUIREMENTS

This section includes performance requirements that CapTOP must satisfy. The CapTOP performance requirements are described in TABLE 28 below.

TABLE 28 Performance Requirements

Source	ID	Requirement Description	Priority
ConOps 4.1	PR-SYS-1	CapTOP, operating under a nominal load, shall consume no more than 50% CPU, RAM, network bandwidth, and disk space on any workstation averaged over a 24-hour period.	1
ConOps 4.1	PR-SYS-2	CapTOP, operating under a nominal load, shall consume no more than 50% CPU, RAM, network bandwidth, and disk space on any server averaged over a 24-hour period.	1
SYS-3, SYS-12, SMM-17	PR-SYS-3	CapTOP shall be able to effectively recovery from workstation failures within 15 minutes by failing over to a backup workstation	1
SYS-3, SYS-12, SMM-17	PR-SYS-4	CapTOP shall be able to effectively recovery from communication server, database server, and application server failures within 10 seconds by failing over to hot-backup servers that are kept up to date with the latest software and database information.	1
SYS-3, SYS-12, SMM-17	PR-SYS-5	CapTOP shall provide the necessary hardware to allow all communication devices to be failed over redundant servers.	1
SYS-3, SYS-12, SMM-17	PR-SYS-6	A backup of all CapTOP application, database, and communication server software shall be provided to maintain operations in the event of a catastrophic failure.	1
ConOps 3.3, SYS-3, SYS-12, SMM-17	PR-SYS-7	CapTOP shall be fully operational and functioning 24 hours a day, 365 days a year, with a 99.9% or greater availability (not including regularly scheduled maintenance) to minimize downtime.	1