DISTRICT DEPARTMENT OF TRANSPORTATION
55 M Street, SE, Suite 400
Washington, DC 20003

CAPITAL TRAFFIC OPERATION PLATFORM (CAPTOP)

PHASE 1: SOFTWARE FUNCTIONAL REQUIREMENTS DEVELOPMENT

FUNCTIONAL REQUIREMENTS DOCUMENT (FRD)

DISTRICT OF COLUMBIA
DISTRICT DEPARTMENT OF TRANSPORTATION

October 31, 2012

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DOCUMENT REVISION PAGE

Revision	Description	Revised by	Date
Revision 1.0	Draft Release	BG, QL, ME	06/15/09
Revision 1.1	Release 1.1	B.G., TK	7/7/09
Revision 2	Revised for procurement support	DS	1/5/12
Revision 2.1	Revised priorities	DS	4/2/12
Revision 2.3	Added parking management, streetcar interface and updated tunnel (SCADA) interface	DS	6/18/12
Revision 2.4	Revised existing equipment inventory	DS	7/6/12
Revision 2.4.1	Editorial corrections	DS	8/3/12
Revision 2.5	Requirement priorities revised to identify core requirements	DS	9/14/12
Revision 2.5.1	Review comments addressed	DS	10/31/12
Revision 2.5.2	Editorial corrections related to RFP review	DS	01/02/13

Technical Report Documentation Page

1. Report No. DDOT-TOA-CAPTOP-2008-004	2. Report Date October 24, 2012
3. Title and Subtitle CapTOP Phase 1: Software Functional Requirements Development Task 4: Functional Requirements Document	4. Contract or Grant No. Original POKA-2006-T-0055-VH Revision DCKA-2010-T-0043
5. Author(s) Original Barry Grasso, Qiang Li, Manzur Elahi Revision Dwight Shank	
6. Performing Organization Name and Address Original Daniel Consultants, Inc. 8950 Route 108 East, Suite 229 Columbia, Maryland 21045 Revision Iteris, Inc. 107 Carpenter Drive, Suite 230 Sterling, VA 20164	7. Type of Report and Period Covered. Original Task 3 Report November 2008 – July 2009 Revision Task 2.1 Report Rev 4 August 2011 – September 2012
8. Sponsoring Agency Name and Address District of Columbia District Department of Transportation 55 M Street, SE, Suite 400 Washington, DC 20003	
9. Supplementary Notes None	

10. Abstract

The objective of this report is to document the Functional Requirements for the CapTOP program. This document includes a structured list of prioritized functional requirements organized by functional area. The revision updates the document to reflect evolution in system requirements and correct errata.

11. Key Words CapTOP, Functional Requirements, ATMS, District of Columbia, ITS	12. Distribution Statement No restrictions. This document is available through DDOT.

13. Security Classif.(of this report) Unclassified	14. Security Classif.(of this page) Unclassified	15. No. of Pages 300	16. Price N/A

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ACRONYMS

Abbreviation	Full Text
AADT	Annual Average Daily Traffic
ANSI	American National Standards Institute
API	Application Program Interface
ASCII	American Standard Code for Information Interchange
ATC	Advanced Traffic Controller
ATMIS	Advanced Traffic Management & Information System
ATMS	Advanced Traffic Management System
AVI	Automatic Vehicle Identification
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
CSV	Comma Separated Value
DBMS	Database Management System
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 (now HSEMA)
ESRI	Environmental Systems Research Institute
FCC	Federal Communications Commission

FHWA	Federal Highway Administration
FRD	Functional Requirements Document
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphical User Interface
H/W	Hardware
HAR	Highway Advisory Radio
HSEMA	Homeland Security and Emergency Management Agency
IM	Incident Management
IPMA	Infrastructure Project Management Administration
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
LAN	Local Area Network
LOS	Level Of Service
MD	Maryland
MDOT	Maryland Department of Transportation
MOE	Measures of Effectiveness
MPD	Metropolitan Police Department
MPEG	Moving Picture Experts Group
MPH	Mile Per Hour
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
MWCOG	Metropolitan Washington Council of Governments
NAS	Networked Archive Storage
NAWAS	National Warning System
NCR	National Capital Region
NOAA	National Oceanic and Atmospheric Administration
NOVA	Northern Virginia
NTCIP	National Transportation Communications for ITS Protocol
NTSC	National Television System Committee
NVR	Network Video Recorder
NWS	National Weather Service
ORD	Operational Requirements Document
OITI	Office of Information Technology and Innovation
PC	Personal Computer
PDA	Personal Data Assistant
PDMS	Portable Dynamic Message Sign

POC	Point of Contact
RAID	Redundant Array of Independent Disks
RDBMS	Relational Database Management System
RICCS	Regional Incident Communications and Coordination System
RITIS	Regional Integrated Transportation Information System
ROC	Roadside Operations Computers
ROP	Roadway Operations Patrol
RPM	Rotations Per Minute
RTM	Requirements Traceability Matrix
RTMS	Roadway Traffic Monitoring System
RWIS	Roadway Weather Information System
S/W	Software
SCADA	Supervisory 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
TMDD	Traffic Management Data Dictionary
TSO	Transportation System Operator
UCC	Unified Communications Center
UMD	University of Maryland
USCP	United States Capitol Police
VA	Virginia
VCR	Video Cassette Recorder
VDOT	Virginia Department of Transportation
VIPS	Video Interoperability for Public Safety
VPN	Virtual Private Network
VGA	Video Graphics Array
WAN	Wide Area Network
WASA	Water and Sewage Authority
WIM	Weigh-in-Motion
WMATA	Washington Metropolitan Area Transit Authority
XML	Extensible Markup Language

XVGA	Extended Video Graphics Array

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.

Under a previous contract, an inventory and analysis of existing DDOT ITS systems and software were performed, stakeholder interviews were conducted, operational objectives and user needs were identified, a Concept of Operations was developed, an Operational Requirements Document was developed, and a Functional Requirements Document was developed. The current work revises the previous versions of the Functional Requirements Document to prepare the functional requirements as found in this document for support of a successful system procurement, to correct technical and editorial errors in the previous versions, and to reflect ongoing evolution in ITS industry practices. The functional requirements describe the capabilities and functions to be performed in the CapTOP system. The development of TMC functional requirements documented in this report involved the analysis of what the system needs to perform. The functional requirements support and are consistent with findings produced by the prior contract and documented in Technical Memorandum 1: Document Review Findings (ref 3), Technical Memorandum 2: Interview Findings and Stakeholders' Needs(ref 0), the Task 2 Report: Concept of Operations (ref 0), and the Task 3 Report: Operational Requirements(ref 0).

The functional requirements are categorized and structured in a tabular, hierarchical format in this document. A coding scheme is used to organize the requirements around functional areas. A Computer-Aided Software Engineering (CASE) tool was used to ensure traceability among functional requirements, operational requirements, user needs, and scenarios (i.e., use cases). The database of requirements in the CASE tool has been updated in concert with the revisions to this document.

1.1 Purpose

This Functional Requirements Document (FRD) is used in conjunction with the Concept of Operations (ConOps) document and the Operational Requirements Document (ORD) 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 supports 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 were the basis for the operational requirements that guided development of the functional requirements described in this document.

1.2 Scope

The development of TMC functional requirements documented in this report involved the analysis of what, when and how well the system needs to perform. The functional requirements in this document were derived mainly from the following four (4) documents:

- Technical Memorandum 1: Document Review Findings[ref 3];
- Technical Memorandum 2: Interview Findings and Stakeholders Needs[ref 0];
- Task 2 Report: Concept of Operations[ref 0];
- Task 3 Report: Operational Requirements[ref 0].

A complete list of documents referenced is provided in Section 2.

This FRD covers the analysis of what CapTOP needs to perform and defines the functional requirements that CapTOP needs to implement in order to satisfy the concept of operations and the operational requirements.

1.3 Organization of Functional Requirements

The functional requirements are organized into categories grouping similar requirements together. To maintain a common structure and facilitate traceability, the functional 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 AAA-BBB.C.D.E.F where:
    - AAA = a 3-character identifier to indicate the type of functional requirement (e.g., DMS); (See Table 1 for a complete list.)
    - BBB.C.D.E.F = a numeric identifier to uniquely identify the requirement within a functional area (e.g., 100.1.1); Fields C, D, E, and F are optional and are used to structure hierarchical requirements.

- **ORD Req ID** – A unique identifier that allows the source/originator of the requirement to be traced. The "ORD Req ID" identifier traces back to an operational requirement identified in Task 3 Report: Operational Requirements[ref 0].

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

- **Priority** –A 1-digit number representing the relative priority of the requirement or a "C", where "C" represents a Core function of the system that must be present in all operational versions, 1 = high, 2 = medium, and 3 = low. Note: the priorities of the functional requirements have been refined from what was documented in the ORD and Release 1 of this document.

- **Test Method** – One of demo, test, analyze or inspect. Refer to section 1.6 Test Methods for additional information.

TABLE 1 below provides a list of the type of functional requirements used in this document.

TABLE 1 Functional Areas

Functional Areas	Code
Archive Database	ADB

Functional Areas	Code
Congestion Alerts	CGA
Closed-Circuit Television	CCT
Critical Infrastructure Protection System	CIP
Configuration Database	CDB
Configuration Management System	CMS
CVISN	CVN
Database Architecture	DBA
Database Backup and Failure	DBF
Database Reports	DBR
Database Security	DBS
Database Warehouse and Archiving	DWA
Department of Public Works Interface	DPW
Dynamic Message Signs or Portable Dynamic Message Signs	DMS
Emergency Management/Evacuation	EME
GIS Database	GDB
Graphical User Interface	GUI
Hardware	HWR
Highway Advisory Radio	HAR
Homeland Security and Emergency Management	HSE
Incident Management	INM
Logging Requirements	LOG
Map Display	GUI
Metropolitan Police Department	MPD
Operations Database	ODB
Parking Management Interface	PAM
Performance Requirements	PER
Permanent Count Stations	PCS
Regional Traffic Coordination	RTC
Regional Weather Interface	REW
Roadway Weather Information System Interface	RWI
SCADA Interface	SCA
Special Event Management	INM
SpeedInfo Interface	SPD
StormTrak	STI
Streetcar Interface	STC
System Level Requirements	SYS
System Maintenance Contractor's Work Order Maintenance Database	SMC
Traffic.com Interface	TDC
Traffic Data Analysis	TDA
Traffic Detection Stations	TDC
Traffic Signals	SIG
Video Aircraft Downlink Requirements	VAD
Asset Management Interface	ASM

1.4 System Overview

This section provides an overview of the envisioned CapTOP system.

This section includes information about the system's environment in terms of the following categories:

- Facilities

- Hardware and Equipment
- Software
- Personnel
- Operational Procedures
- Support Necessary to Operate the Deployed System

FIGURE 1 illustrates the CapTOP system context diagram. This diagram identifies the interfaces between CapTOP and various systems, centers, and devices.

1.4.1 Facilities

The DDOT Traffic Management Center (TMC) is a 24x7x365 traffic management facility. Primary server and communication equipment along with operational equipment is located on the 2nd floor of the Reeves Center, which is located at 2000 14th Street, NW, in Washington, DC. Operational equipment for the TMC is located on the 2nd floor of the UCC to leverage the infrastructure capabilities of that facility. Refer to Section 3.1 of the Task 2 Report: Concept of Operations (*ref* 0) for additional information. The TMC serves as the management and control center in the District, and provides monitoring and control over all DDOT's ITS assets. The Transportation System Operators (TSOs), whom operate the system, are located in the UCC, while the maintenance, Roadway Operations Patrols (ROPs), and support personnel are located at the Reeves Center. The Reeves location also houses the spare ITS field devices.

While many offices of DDOT staff are located at 55 M Street, SE, no permanent facilities are planned for installation there. Access to CapTOP capabilities will be provided using office automation computers and DDOT staff laptops across DC network connections. Access provided by the public Internet will also be available at this location.

The TMC supports regional emergency management functions and information sharing and integration with MDOT, VDOT and Washington Metropolitan Area Transit Authority (WMATA). The TMC serves as a command and control center to integrate new functions identified in the area of homeland security, including Critical Infrastructure Protection (CIP), interoperable communications, intelligence/information sharing, information gathering, and information dissemination.

CapTOP is supported by an operations and development environment as follows:

1. Operations Environment – this environment houses the production system, which is the "live" system to manage day-to-day traffic operations.
2. Development Environment – this environment is used for software development, testing, simulation and training where items such as patched software, new releases, and new control strategies are tested in an offline configuration.

1.4.2 Hardware and Equipment

This section is subdivided into field hardware and center hardware. The CapTOP program interfaces with a variety of ITS field devices and/or servers, including CCTV, vehicle detectors,

RWIS, DMS, HAR, and a traffic signal system. A description of each of these devices is provided in Section 3.1 of the Task 2 Report: Concept of Operations (ref 0).

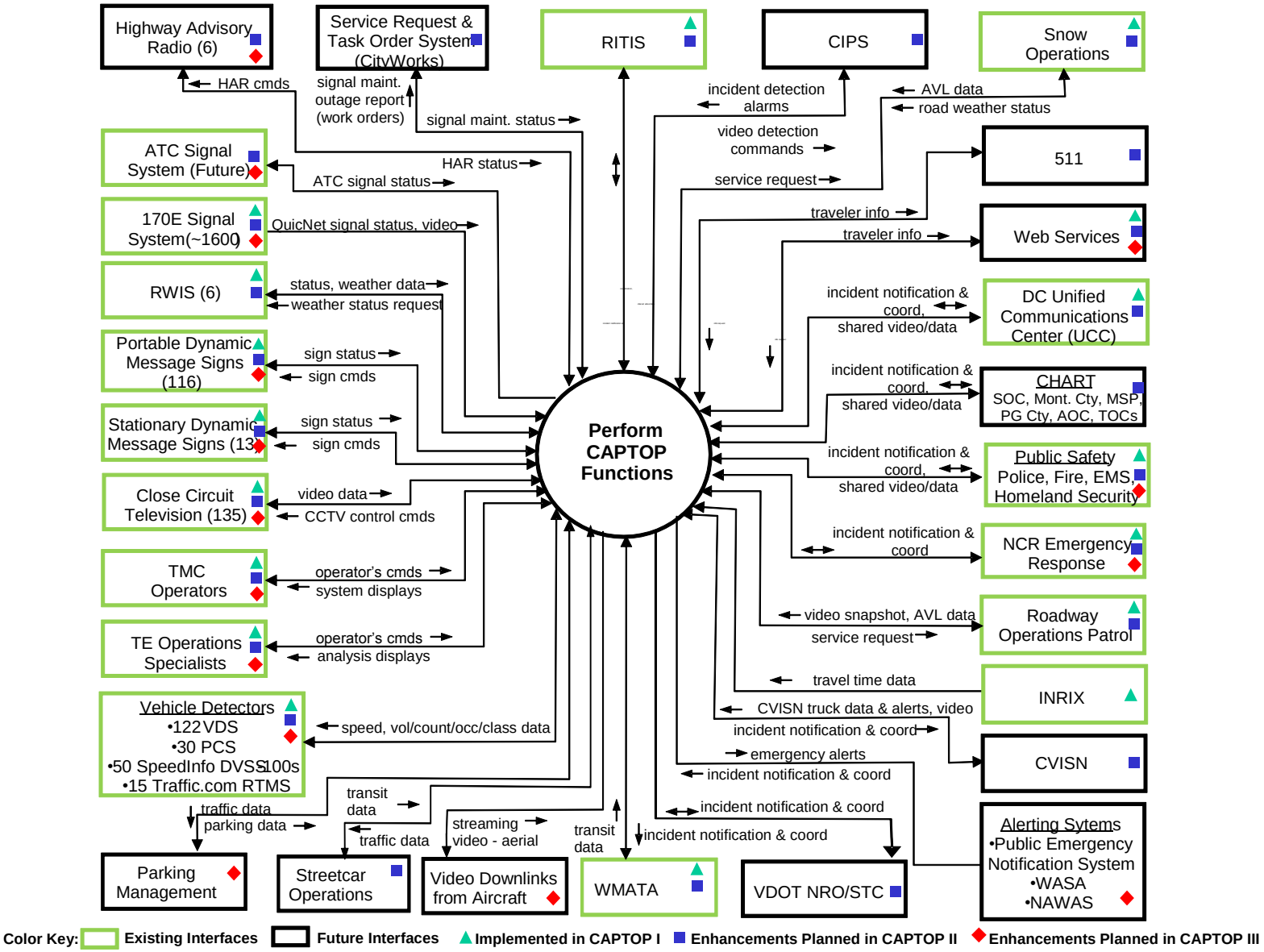

Highway Advisory Radio (6)
Service Request & Task Order System (CityWorks)
RITIS
CIPS
Snow Operations
HAR cmds
signal maint. outage report (work orders)
signal maint. status
incident detection alarms
AVL data
road weather status
video detection commands
ATC Signal System (Future)
HAR status
ATC signal status
service request
511
170E Signal System(~1600)
QuicNet signal status, video
traveler info
traveler info
Web Services
RWIS (6)
status, weather data
weather status request
incident notification & coord, shared video/data
DC Unified Communications Center (UCC)
Portable Dynamic Message Signs (116)
sign status
sign cmds
incident notification & coord, shared video/data
CHART
SOC, Mont. Cty, MSP, PG Cty, AOC, TOCs
Stationary Dynamic Message Signs (13
sign status
sign cmds
Perform CAPTOP Functions
incident notification & coord, shared video/data
Public Safety
Police, Fire, EMS, Homeland Security
Close Circuit Television (135)
video data
CCTV control cmds
incident notification & coord
NCR Emergency Response
TMC Operators
operator's cmds
system displays
video snapshot, AVL data
service request
Roadway Operations Patrol
TE Operations Specialists
operator's cmds
analysis displays
travel time data
INRIX
Vehicle Detectors
•122 VDS
•30 PCS
•50 SpeedInfo DVSS
•15 Traffic.com RTMS
speed, vol/count/occ/class data
CVISN truck data & alerts, video
incident notification & coord
CVISN
emergency alerts
incident notification & coord
incident notification & coord
transit data
traffic data
parking data
traffic data
streaming video - aerial
transit data
incident notification & coord
Alerting Sytems
•Public Emergency Notification System
•WASA
•NAWAS
Parking Management
Streetcar Operations
Video Downlinks from Aircraft
WMATA
VDOT NRO/STC
Color Key:
Existing Interfaces
Future Interfaces
Implemented in CAPTOP I
Enhancements Planned in CAPTOP II
Enhancements Planned in CAPTOP III

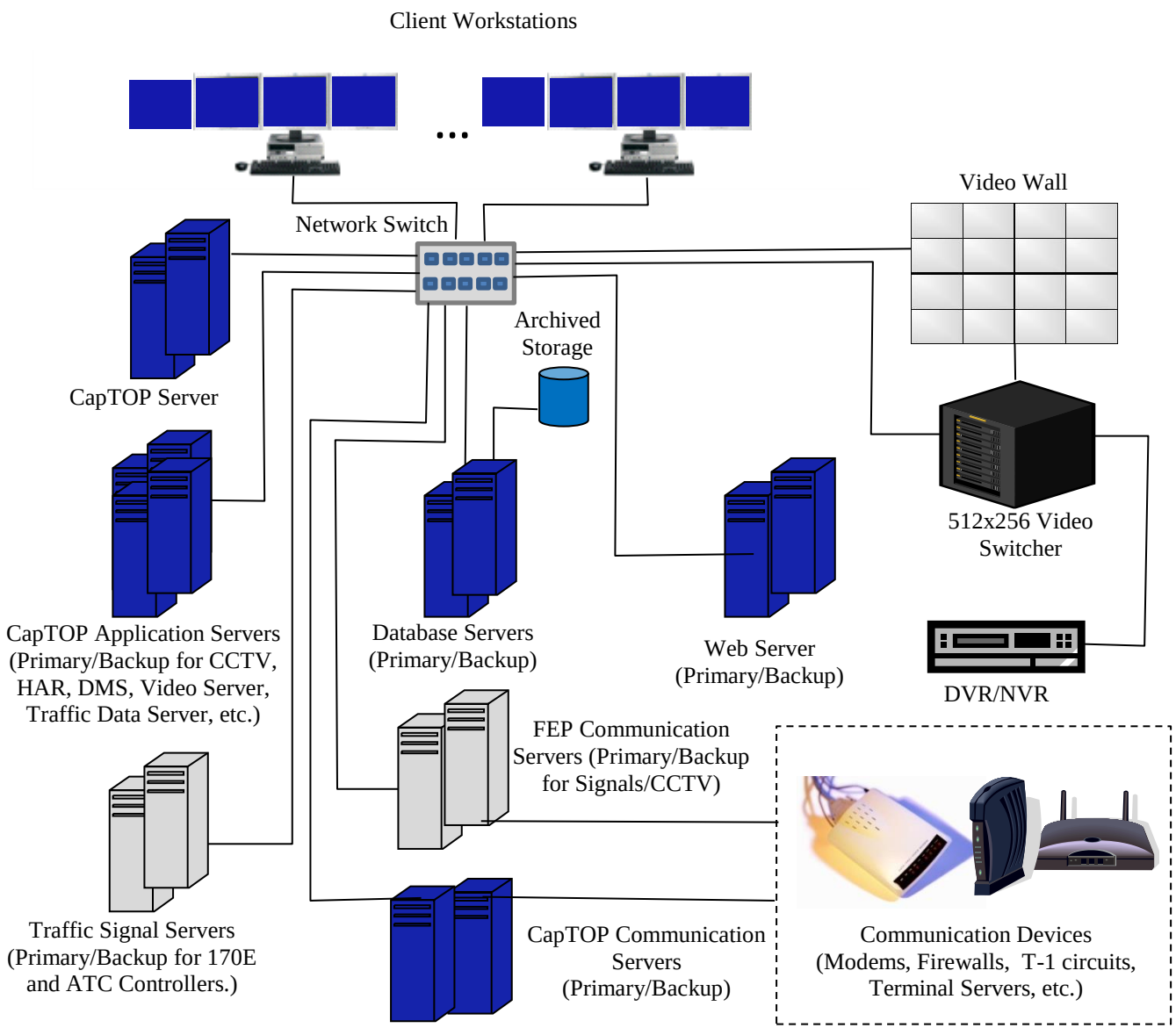
FIGURE 1 Context Diagram for CapTOP System

With regard to the central hardware, refer to FIGURE 2 for a diagram illustrating the CapTOP central hardware configuration. For the CapTOP implementation, the following hardware is anticipated:

- **Client Workstations** – one for each operator in each shift. The CapTOP user interface is graphical and GIS-based; therefore, 4-headed monitors are envisioned with leading edge dual Intel-based processors.
- **Network Switch** – a 10/100/1000Base-T Ethernet switch is required for network connectivity and the display of live IP video. The CapTOP software executes in a distributed computing environment utilizing the Transmission Control Protocol/Internet Protocol (TCP/IP) to communicate between software applications.
- **Video Switcher** – a 512 input x 256 output analog NTSC video switcher is required for legacy video.
- **Application Servers** – the number of these servers varies based on the number of subsystems deployed, the processing power of the server, and how many ITS devices each of those subsystems is required to support.
- **Database Servers** – these servers host relational database management software with built-in redundancy for high availability.
- **Communication Servers** – these servers are used to provide center-to-center and center-to-field communications using T-1 connections, dialup modems, firewalls, terminal servers, and wireless modems. TCP/IP and serial protocols are used to communicate with all devices. Where available, standard protocols, such as NTCIP, will be utilized.

As previously discussed, the hardware and software discussed in this section is available in the operational environment, and a replica copy (though on a smaller scale) in the development (or support) environment.

In addition to the field and center hardware identified above, the CapTOP architecture supports the addition of future ITS field devices and center hardware.



Note: The Traffic Signal Servers and FEP Communications Servers are part of the existing Signal System. CapTOP will interface to these systems. They are shown here for completeness. They are not considered part of CapTOP.

FIGURE 2 CapTOP Hardware Architecture

TABLE 2 provides a listing the various types of devices that are under the purview of the CapTOP system.

TABLE 2 CapTOP ITS Devices

Device Type	Existing Quantity	Under Central Control	Network	Manufacturer	Model #	Protocol Used
CCTV	150	Yes	Twisted Pair	Honeywell	KD6	Proprietary Phillips/Bosch
170E Traffic Signals	~1700	Yes	Twisted Pair	McCain	170E	Proprietary QuickCom (McCain)
ATC Traffic Signals	TBD	TBD	TBD	TBD	TBD	NTCIP
HAR	6	Yes	Cellular	HIS (Quixote)	DR1500AM Recorder/Player AM Transmitter Module: Model DRTXM2 BlackMax for Radio Transmitter	Proprietary Quixote DR1500
RWIS	6	Some	Twisted Pair and Spread Spectrum	SSI (Quixote)	SSRI 900 Freeware	Proprietary SSI, Use SCAN Server Data Export Software API
Portable DMS	43	Yes	CDMA/EVDO	VER-MAC (Centralo is central software)	3048SCEN2008, 3056SCEN2007	NTCIP
Portable DMS for Speed Monitoring	6	No	None - No centralization potential at all	TrafficLogix	SJT-02	Bluetooth for local communication with a laptop.
Fixed DMS	2 Existing 11 Planned	No	None	Existing Mark IV, Planned TBD	Existing FP9000-NL, Planned TBD	Existing Proprietary, Planned NTCIP
SpeedInfo Speed Detectors	46	No	None	Doppler (SpeedInfo)	DVSS-100	Interface is to SpeedInfo's Server via Traffic Data Server
RTMS SVO Detectors	15	No	None	RTMS (Traffic.com)	RTMS	Interface is to Traffic.com's Server via Traffic Data Server
Video Switcher	512 Inputs/ 256 Outputs	Yes	Coax	Bosch	Allegiant	Proprietary Phillips/Bosch
Video Wall	1	Yes	Coax	Clarity	Lion Wn-6720-sx, Lion Wn-4030-S	Proprietary Crestron Video Wall Controller
Permanent Count Stations	30 Planned	Yes	Twisted Pair and Spread Spectrum	(Various): Loops (20) w/piezos, Video (1-Traficon), RTMS (5-EIS), IR (1-Tirtl), Acoustic (1 - SmarTek)	ATRs; 5 different servers	Interface is to Proprietary Protocols (Roadtrax, Traficon, EIS, Tirtl, SmarTek) via Traffic Data Server

Device Type	Existing Quantity	Under Central Control	Network	Manufacturer	Model #	Protocol Used
Traffic Detection Stations	122 Planned	Yes	Twisted Pair and Wireless	TBD - Contract is not yet awarded	In-Pavement Wireless Sensor	Interface is to Proprietary Protocol via Traffic Data Server
Weigh-In-Motion (WIM) Stations	3	Yes	Count, classification, and weight	International Road Dynamics	Single Load Cell	Proprietary via XML using C2C.

1.4.3 Software

The CapTOP software consists of a large number of processes (software applications) that interact in a cooperative environment, as subsystems, to provide CapTOP functionality. FIGURE 3 provides an illustration of the envisioned CapTOP software architecture.

Each CapTOP subsystem is described below:

- **Operator Interface Subsystem** – this subsystem provides an intuitive graphical user interface (GUI). An integral part of the GUI is the Geographical Information System (GIS) – based map display, which provides spatial and temporal functions linking traffic management activities to real-world maps.
- **DMS Subsystem** – this subsystem provides monitor and control functions for the DMS/PDMS devices.
- **CCTV/Video Subsystem** – this subsystem provides monitor and control functions for the CCTV cameras, as well as the video switcher and video wall.
- **HAR Subsystem** – this subsystem provides monitor and control functions for the HAR devices.
- **Vehicle Detection Subsystem** – this subsystem provides monitor and control functions for the various types of vehicle detectors, including loops, piezos, radar-based devices, etc. Some detectors are sponsored by 3rd parties and are read-only (i.e., no control). This subsystem is based off 3rd party COTS products.
- **Signal Subsystem** – this subsystem provides monitor and control functions for the 170E traffic control signals via QuicNet™ and also ATC controllers via the future ATC software. This subsystem is based off 3rd party COTS products. The interface between CapTOP and QuicNet, and between CapTOP and the ATC software is

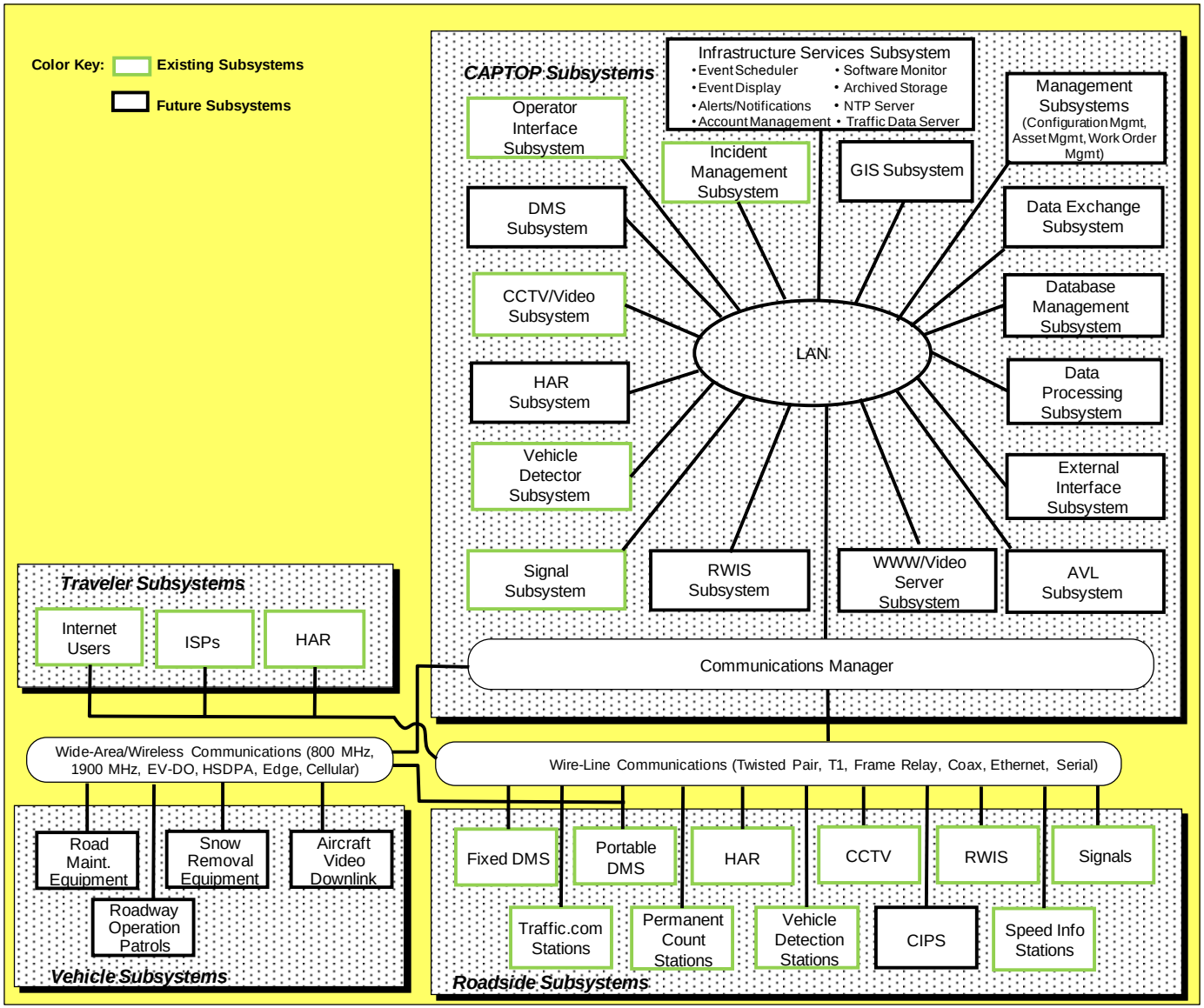


FIGURE 3 CapTOP Software Architecture

limited to monitoring functions only. All signal control functions are handled from within the QuicNet and the ATC software packages.

- **Infrastructure Services Subsystem** – this subsystem provides services that are available to the operator and multiple subsystems, including the following:
    - **Event Scheduler** – this service schedules recurring and non-recurring events to remind the operator to take action. This can include scheduled DMS/PDMS messages (e.g., display a new message, or blank sign), HAR messages, alerts, or CCTV tours to be run.
    - **Event Display** – this service provides the ability to display all system, application, and operator events and alerts to the operator.
    - **Alert System** – this service provides alerts in the form of emails, text messages or paging messages to individual subscribers or distribution lists.
    - **Account Management** – this service provides the ability to manage (add, delete, change) user accounts, passwords, and groups.
    - **Software Monitor** – this service provides the ability to monitor, stop, and restart critical software processes.
    - **Archived Storage** – this service provides the necessary storage infrastructure (e.g., RAID, NAS, jukebox, etc.) to support the data archive.
    - **NTP Server** – this service provides Network Time Protocol (NTP), time synchronization data to all workstations, servers, and controllers.
    - **Traffic Data Server** – this service provides the server software to integrate data from vehicle detection stations, permanent count stations, Traffic.com stations, SpeedInfo stations, INRIX, and WIM stations. This accomplished using a collection of processes that collects the data and stores the data in CapTOP's operations database.
- **Incident Management Subsystem** – this subsystem provides robust incident management functions, including special event management. Support is provided for automated response plans, as well as on-line procedures.
- **GIS Subsystem** – this subsystem provides the map based capability that works in conjunction with the GUI. This subsystem is based off 3rd party COTS products.
- **RWIS Subsystem** – this subsystem provides monitor-only functions for the RWIS devices, which are managed by a 3rd party.
- **WWW/Video Server Subsystem** – this subsystem provides data that will be disseminated on the Internet, including live traffic video (or snapshots), congestion, incident, special event, and construction information. This subsystem also facilitates video sharing between other agencies and centers.
- **Management Subsystems** – this subsystem supports three separate applications:
    - **Asset Management** – this application provides the ability to manage mobile and fixed assets. The software centrally manages the inventory of assets, their

location, the users of them, configuration and warranty information, and all costs associated with the various assets. This subsystem is based off 3rd party COTS products.

- **Work Order Management** – this application provides the ability to enter, schedule, and track work orders. This subsystem also provides the ability to enter and track customer complaints, such as signal outages. This subsystem is based off 3rd party COTS products.
- **Configuration Management** – this application provides an integrated source code baseline for all aspects of the project. This subsystem provides version control, with version numbers, and descriptions to identify what is changed for each release.

- **Data Exchange Subsystem** – this subsystem provide interfaces to the other systems (e.g., CIPS, RITIS, INRIX, etc.) for the purpose of transmitting and receiving traffic and incident data. One of the supported interfaces is a standard interface for the purpose of exchanging two-way incident and video information with other centers (i.e., center-to-center), agencies, or private sector companies. CapTOP will provide a mechanism for exchanging two (2) types of data:
  - **Traffic data** – this type of data is pushed to other centers and includes traffic condition data (e.g., speed, volume, and occupancy), incident information (e.g., accidents, construction, and lane closure), special event information, video, and current device status (e.g., DMS/PDMS messages, HAR messages, etc.);
  - **Command/Control data** – this type of data is when an operator in one center issues a command to another center to change the current state of an ITS device (e.g., an operator can send a request to change a DMS/PDMS that another center operates).
- **Database Management Subsystem** – this subsystem provides relational database management functions, including redundancy and mechanisms to provide high availability. This subsystem is based off 3rd party COTS products.
- **Data Processing Subsystem** – this subsystem is responsible for providing the following services:
  - **Data Collection and Analysis** – a collection of applications that provide access to historical traffic, incident, and performance data. Also provides tools that support graphical displays, statistical analysis, and data mining.
  - **Data Warehousing and Archiving** – provides a repository for electronically stored data. Includes software and hardware that support electronic storage and retrieval of traffic data, response plans, timing plans, ITS device status, system event log, measures of effectiveness and other data. A collection of applications to support various reporting and analysis functions, and to provide a means to retrieve and analyze data, to extract, transform, load, and display data.

- **External Interface Subsystem** – this subsystem provide custom interfaces to external systems not addressed by the data exchange subsystem (e.g., StormTrak, CVISN, NCR, etc.).
- **Automatic Vehicle Location (AVL) Subsystem** – this subsystem provides automated tracking of AVL-equipped vehicles, such as ROPS and maintenance vehicles. This subsystem is based off 3rd party COTS products.

1.4.4 Personnel

This section describes the different types of personnel necessary to operate the CapTOP system. The following personnel are necessary to staff CapTOP:

- **Operations Personnel** – are responsible for traffic management functions and are knowledgeable and experienced in the various aspects of ITS including, monitoring, incident management, traffic control, dispatch, and traffic information dissemination. The staff consists of a TMC Manager and TMC operators. Staffing requirements are based on the size of the system, the number of ITS devices, the average daily number of incidents, and the need to conduct 24x7x365 operations. Refer to TABLE 3 for the hours of operation and staffing levels based on DDOT's existing system.

TABLE 3 Operations Personnel Staffing

Day of Week	Shift	Hours	# Supervisors (Leads)	# Operators
Weekdays	Morning	5:30 AM – 3:30 PM	1	4
	Mid	2:30 PM – Midnight	1	3
	Night	10:30 PM – 8:00 AM	1	4
Weekends	Morning	5:30 AM – 3:30 PM	1	1
	Mid	2:30 PM – Midnight	1	1
	Night	10:30 PM – 8:00 AM	1	1

- **Maintenance Personnel** – are responsible for corrective and preventive maintenance of all ITS assets. The maintenance staff consists of one (1) supervisory engineering technician (supervisor), seven (7) engineering technicians, one (1) IT technician, one (1) electrical engineering technician, and two (2) electronics mechanics. Staffing requirements are based on the size of the system, the number of ITS devices, and the average daily number of devices to service. Refer to TABLE 4 for the hours of operation and staffing levels based on DDOT's existing system.

TABLE 4 Maintenance Personnel Staffing

Day of Week	Shift	Hours	# Supervisors (Leads)	# Personnel
Weekdays	Morning	7:00 AM – 3:30 PM	1	11
	Mid	2:30 PM – Midnight	N/A	N/A
	Night	10:30 PM – 7:00 AM	N/A	N/A
Weekends	Morning	5:30 AM – 2:30 PM	N/A	N/A
	Mid	2:30 PM – Midnight	N/A	N/A
	Night	10:30 PM – 7:00 AM	N/A	N/A

Notes:

1. Maintenance personnel work Mon – Fri only and work special events, as required. All technicians have cell phones and are on-call 24x7x365.
2. Actual start time varies between 6AM and 10:30 AM. End time varies between 2:30 PM and 7:30 PM.
3. In the future, the department may expand to cover other shifts.

- **Roadway Operations Patrols** – provide courtesy roadway patrol assistance to police and emergency personnel in responding to roadway incidents, preventing illegal stops and deliveries, and providing assistance with traffic control for special events in the Central Business District (CBD). ROPs serve as the in the field "eyes and ears" of TMC operators, and keep abreast of conditions and traffic incident management activities. These efforts are aimed at improving traffic flow, decreasing congestion, and improving air quality. The staff consists of an Operations Manager and patrols. These personnel operate 24x7x365. Refer to TABLE 5 for the hours of operation and staffing levels based on DDOT's existing system.

TABLE 5 Roadway Operations Patrol Personnel Staffing

Day of Week	Shift	Hours	# Supervisors (Leads)	# of Patrols
Weekdays	Morning	6:00 AM – 2:30 PM	1	3
	Mid	2:00PM – 10:30 PM	N/A	2
	Night	10:30 PM – 6AM	N/A	2
Weekends	Morning	6:00 AM – 2:30 PM	N/A	3
	Mid	2:00PM – 10:30 PM	N/A	2
	Night	10:30 PM – 6AM	N/A	2

1.4.5 Operational Procedures

This section describes the operational and support procedures used to manage CapTOP. The CapTOP software is being designed and implemented with the following policies and limitations in place:

- The software is designed to support operations on a 24x7x365 basis;
- The software is designed to have at least one operator "in the loop" to implement response plans to incidents;

- All operations activities will be guided by the use of written standard operating procedures for all traffic management activities. This material will be available on-line within CapTOP;
- The software is designed to operate on commercially available operating systems and hardware platforms.

1.4.6 Additional Support Necessary to Operate the Deployed System

This section includes all other supporting labor that is not specifically designated by the operations of the system. This support includes the following personnel:

- **ITS Management Staff** – consists of individuals who are responsible for managing the current and future TMC operations, and maintenance activities.
- **ITS Integration and Development Staff** – consist of individuals who are responsible for managing all integration and development activities for the TMC. This includes integrating and developing new software to address operations needs.

1.5 Definitions

The following terms are used throughout this document:

1. **Archive** – a collection of historical records stored in a separate location.

2. **Archiving** – the process of removing selected data records from active databases and storing them in an archive database. The archive database makes historical information that is normally purged from the system, available for longer time periods.

3. **Backup Database** – a copy (e.g., .bck file) of portions of the master database stored on backup media, and typically transaction log-based.

4. **Business Database** – a logical copy of the master database.

5. **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.

6. **Data Mining** – data processing using sophisticated data search capabilities and statistical algorithms to discover patterns and correlations in data. Also involves the process of sorting through large amounts of data and picking out relevant information.

7. **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);
q. United States Capitol Police (USCP).

8. **Geocoding** – the process of finding associated geographic coordinates (often expressed as latitude and longitude) from other geographic data, such as street addresses, zip codes, landmarks, hyperfills, buildings, areas, etc. With geographic coordinates the features can be mapped and entered into a GIS, or the coordinates can be embedded into media such as digital photographs via geotagging.

   Reverse Geocoding is the opposite: finding an associated textual location such as a street address, from geographic coordinates.

   A **geocoder** is a piece of software or a (web) service that helps in this process.[1]

9. **Incident –** for this document, the definition of an incident is defined to be consistent with the *Traffic Incident Management Handbook* which defines an incident as "any non-recurring event that causes a reduction of roadway capacity or an abnormal increase in demand." Under this definition, events such as traffic crashes, disabled vehicles, spilled cargo, highway maintenance and reconstruction projects, and special events (e.g., ball games, concerts, or any other event that significantly affects roadway operations) are classified as an incident.

10. **Incident Classification –** for this document, the term incident classification is used to identify a process used internally by the incident management subsystem to classify incidents based on their location, incident type, incident subtype, and severity. The classification results in an internal code that is not something useful for the operator, but

[1] Taken from Wikipedia contributors, "Geocoding," *Wikipedia, The Free Encyclopedia*, accessed February 2009

is used by the incident management subsystem to lookup the most appropriate response plan.

11. **Intelligent Transportation Systems (ITS) Devices** – for this document, "ITS Devices" include devices such as, closed-circuit television (CCTV) cameras, Dynamic Message Signs (DMS), Portable Dynamic Message Signs (PDMS), Highway Advisory Radios (HAR), Roadway Weather Information Systems (RWIS), traffic detection stations, permanent count stations, and traffic signals.

12. **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.

13. **Master Database** – the primary database used to store CapTOP data.

14. **Mirrored Database** – a copy of the master database stored on a backup server.

15. **Permanent Count Station** – a DDOT-owned traffic monitoring station that collects traffic speed, volume, occupancy, and classification data.

16. **SCADA** – Supervisory 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.

17. **Traffic Detection Station** – unless noted otherwise, a DDOT-owned traffic monitoring station that collects traffic speed, volume, and occupancy data.

18. **User** – a generic term used to denote the users of the CapTOP system. A user is assigned by the System Administrator to one or more of the following groups, each with varying privilege levels:

    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.

1.6 Test Methods

This section defines the set of qualification methods that will ensure that the requirements specified in this document are met. Demo, test, analyze, and inspect are the four (4) methods that will be used to verify the system requirements. These methods are defined below.

1.6.1 Demo

Demo (short for demonstration) is a variation of the "test" method that is used to verify conformance of functional characteristics to specified requirements by pass/fail criteria without the use of elaborate measurement equipment. Demonstration executes the functions of the system, hardware configuration item(s), and/or computer software configuration item(s) using data in a controlled situation. Observations of the predicted outputs or results demonstrate verification of requirements. Simulated or live data may be used.

1.6.2 Test

To test requires exercising portions of the system hardware and/or software in a controlled manner, to collect the data necessary to evaluate conformance to the specified requirements. Real or simulated input is used to exercise specific segments of the system and to generate predicted outputs. Data are formally recorded in accordance with procedures. Detailed analysis is performed to determine requirements compliance, including comparison of Contractor test results with results generated by Government-owned test equipment/software. Analysis as described here is an integral part of the test method, separate and distinct from the analysis method.

1.6.3 Analyze

To analyze requires the processing of accumulated data, including compilation of data obtained from other methods. Techniques involve interpretation or interpolation/extrapolation of analytical, simulated, or empirical data under defined conditions, or reasoning to show compliance with requirements. Verification by computerized simulations is included in this method.

1.6.4 Inspect

To inspect requires the visual examination of an item and the comparison of pertinent characteristics with a predetermined qualitative and quantitative standard. Inspection is used to verify compliance with specified requirements by examining engineering documentation and products. For example, inspection is generally nondestructive and consists of visual or auditory observations, gauging, or simple measurements without the use of precision measurement equipment. The engineering documentation and products include, but are not limited to, software and hardware flow diagrams, software code, engineering drawings, engineering plans, and design specifications.

1.7 Requirements Traceability

As part of the FRD development effort, a Computer-Aided Software Engineering (CASE) tool was used to ensure there was comprehensive mapping of all requirements, between the FRD and the ORD, and also between the ORD and the user needs. This mapping and the associated system engineering ensured all user needs were captured in the ORD and that all ORD requirements were captured in the FRD. This product, known as a Requirements Traceability Matrix (RTM), is a CASE tool report and is available for review by written request to the ITS System Integration & Development Department within DDOT.

1.8 Document Organization

The document is organized as follows:

- Chapter 1 introduces the document, provides a document purpose, provides a system overview , and defines the purpose and scope of the functional requirements;
- Chapter 2 provides a list of referenced documents;
- Chapter 3 provides the functional requirements grouped by functional area;
- Chapter 4 provides a National ITS Architecture mapping for consistency.

2. REFERENCED DOCUMENTS

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

3. CapTOP Phase 1: Software Functional Requirements Development Technical Memorandum 1: Document Review Findings, District Department of Transportation and Daniel Consultants, Inc., August 1, 2008.

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.

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Technical Memorandum Draft “Operator Tasks and Workstation Requirements (Concept of Operations)", Prepared for District of Columbia Division of Transportation, November 20, 2002, by Philip J. Tarnoff and Dunn Engineering Associates, Document No: 96028-660-1004.

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CHART Lite 3.0 System Design Document, Maryland State Highway Administration, September 2005.

Regional Integration Transportation Information System (RITIS), Center for Advanced Transportation Technology (CATT) Laboratory, All Hazards Forum, October 2006.

Metropolitan Washington Area ITS Architecture Interconnect Matrix, July 17, 2007.

3. FUNCTIONAL REQUIREMENTS

This section describes the functional requirements for the CapTOP system.

3.1 General Requirements

This section is divided into the following subsections:

- System-Level Requirements;
- Qualification Test Requirements for final Product Acceptance
- Training Requirements

3.1.1 System-Level Requirements

3.1.1.1 CapTOP Architectural Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-10	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; g. incorporation of new ITS devices; h. database expansion.	C	Inspect
SYS-20	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.	C	Demo
SYS-30	SR-SYS-3	The CapTOP system shall be configurable to accommodate system/module updates and expansions.	C	Inspect
SYS-40	SR-SYS-6	CapTOP shall provide the ability to support variations in system configurations, and operations through database and configuration file settings.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-40.1	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. Refer to the section **Error! Reference source not found. Error! Reference source not found.** for additional information.	C	Demo
SYS-50	SR-SYS-4	CapTOP shall provide a low-coupling architecture and minimize inter-dependencies between the systems components.	1	Inspect
SYS-60	SR-SYS-5	The CapTOP system architecture shall be both web-based and client-server based.	C	Demo
SYS-70	SR-SYS-16	CapTOP shall provide a platform to support information sharing among DDOT personnel and external organizations.	1	Inspect
SYS-80	SR-SYS-28, UR-TO-13, OR-TID-7, OR-CMM-5, OR-CIP-1, OR-RTC-1	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. WASA; k. NAWAS; l. WMATA; m. DPW; n. DC Streetcar Operations; o. DC Tunnel Operations; p. DC Parking Operations.	a. 2 b. 2 c. 3 d. 1 e. 1 f. 1 g. 1 h. 1 i. 1 j. 3 k. 3 l. 1 m. 2 n. 2 o. 2 p. 3	Demo
SYS-80.1	SR-SYS-28, UR-TO-13, OR-TID-7, OR-RTC-1	CapTOP shall provide the ability to share the following information with the partners above: a. incident data; b. traffic condition data; c. ITS device status; d. live video; e. roadway weather information; f. travel time data; g. current DMS messages; h. current HAR messages; i. regional weather information.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-90	IR-GUI-17	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. network connections. Refer to subsystem requirements for additional details.	C	Demo

3.1.1.2 CapTOP Standards Compliance

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-100	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. Refer to subsystem requirements for additional details.	C	Demo
SYS-100.1	OR-C2C-3	CapTOP shall implement center-to-center communication via the NTCIP 2306 (Application Profile for XML Message Encoding and Transport in ITS Center to Center Communications - NTCIP C2C XML) standard to facilitate interagency communications and data exchange with other TMCs.	1	Demo
SYS-110	SR-SYS-8	CapTOP shall utilize the latest published NTCIP standards for all NTCIP compliant field devices unless otherwise approved by DDOT. Refer to subsystem requirements for additional details.	1	Demo
SYS-120	SR-SYS-7	CapTOP shall provide an architecture that is consistent with the National ITS Architecture.	1	Inspect

3.1.1.3 System Level Functional Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-130	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;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		e. event recording; f. event visualization.		
SYS-140	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.	C	Demo
SYS-150	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	Demo
SYS-150.1	SR-SYS-13	CapTOP shall prohibit the use of dedicated workstations for specific functions.	1	Demo
SYS-150.2	SR-SYS-23, OR-C2F-3	CapTOP shall provide the TMC Operator with operational functions to monitor and control the following field devices for any CapTOP workstation: a. 170E-based traffic signals (monitoring only via QuicNet); b. ATC-based traffic signals (monitoring only via the future Traffic Signal System); c. CCTV cameras; d. DMSs; e. PDMSs; f. HARs; g. RWISs (monitoring only); h. traffic detection stations (monitoring only); i. Traffic.com stations (monitoring only); j. SpeedInfo stations (monitoring only); k. WIM stations (monitoring only); l. Permanent count stations (monitoring only). Refer to subsystem requirements for additional details.	C, items b and k priority 2	Demo
SYS-150.3	SR-SYS-9	CapTOP shall provide a platform that provides integrated access to the following software applications: a. QuicNet 170E-based Signal System; b. CityWorks; c. ATC-based Signal System; d. A contractor work-order tracking system for signal maintenance.	Item a C, items b and d priority 1, item c priority 2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-170	SR-SYS-22, OR-PM-2	CapTOP shall provide comprehensive reporting capabilities 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. Traffic detector management; g. RWIS management; h. Incident management; i. Congestion monitoring; j. Operator productivity; k. Operator effectiveness; l. CapTOP management. Refer to subsystem requirements for additional details.	2	Demo
SYS-180	SR-SYS-36	CapTOP shall be able to generate real-time reports on device equipment status for the following subsystems: a. DMS; b. PDMS; c. CCTV; d. HAR; e. RWIS; f. Traffic Detection Stations; g. Traffic.com Stations; h. SpeedInfo Stations; i. WIM Stations; j. Permanent Count Stations; k. Signals. Refer to subsystem requirements for additional details.	1, item i priority 2	Demo
SYS-190	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. Refer to subsystem requirements for additional details.	Items a and b C, items c, f, g, and h priority 1, items d and e priority 2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-200	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. Refer to the Database section for additional information.	1	Demo
SYS-210	SR-SYS-25, OR-TDCA-19, OR-MMC-3	The CapTOP system shall operate in the following modes: a. **Startup Mode** – This mode starts all systems orderly and renders the TMC operable. b. **Normal Mode** – This is the normal operational mode of the system in which all services are available. The TMC is staffed with a TMC Manager and operators 24x7x365 in accordance with the staffing plan. From this mode, the system can transition to any of the other modes below. c. **Maintenance Mode** – This operational mode will be used when system upgrades or repairs are taking place. The system will be capable of running from a single workstation/server in this mode. d. **Development/Simulation/Training Mode** – This mode will be used periodically for activities, such as testing a new software release, simulating a new control strategy/tactic, or the training of a new operator. This mode typically executes on a non-operational set of hardware. e. **Backup Mode** – This operational mode will be used in the event of a catastrophic failure at the Primary TMC. In this scenario, backup operations will occur at the backup TMC. Refer to DBF-10* and SYS-260* for more information. f. **Shutdown Mode** – This mode shuts down all systems orderly and renders the TMC inoperable.	1	Demo
SYS-210.1	OR-MMC-3	CapTOP shall provide an online training mode to train TMC Operators, Managers, Maintenance Technicians, and other users that require CapTOP access.	3	Demo
SYS-210.2	OR-MMC-4	CapTOP shall provide a limited set of test devices, 1 or more per subsystem, to use in training mode.	3	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-210.2.1	OR-MMC-4	The limited set of devices shall include the following: a. Backup workstations and servers; b. One (1) CCTV test/training device; c. One (1) DMS test/training device; d. One (1) HAR test/training device; e. One (1) Traffic Signal test/training device; f. One (1) TDS test/training station; g. One (1) PCS test/training station.	3	Demo
SYS-210.3	OR-MMC-5	CapTOP shall limit the devices that can be monitored and controlled in the training mode to only the test devices.	3	Demo
SYS-210.4	OR-MMC-6	CapTOP shall limit the functions that can be invoked in the training mode to only the functions that are applicable based on the user's privilege level.	3	Demo
SYS-220	SR-SYS-19	CapTOP shall provide time synchronization between all network nodes using the Network Time Protocol (NTP) standard.	1	Demo
SYS-230	SR-SYS-15	CapTOP shall provide on-line access to the following files stored in a Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Visio, or Adobe PDF format: a. User Manuals; b. Software Maintenance Manuals; c. Hardware Maintenance Manuals; d. Troubleshooting Guides; e. Standard Operating Procedures; f. DDOT Policies; g. Incident Response Plans.	1	Demo
SYS-240	OR-SMM-10	CapTOP or related third party software shall provide the necessary hardware and software to perform manual image backups of all workstations and servers ensuring all system, software, and data is backed up.	1	Demo
SYS-250	OR-SMM-10	CapTOP shall provide the necessary hardware and software to perform automated incremental backups of all workstations located at the TMC and backup TMC and all servers, ensuring that all system, software, and data are backed up nightly.	1	Demo
SYS-250.1	OR-SMM-10	The nightly backups shall be able to be configured by the System Administrator to perform incremental backups (i.e., only files that changed from the previous backup) or a complete system backup of all files.	1	Demo
SYS-260	PR-SYS-4	CapTOP shall provide a copy of the CapTOP system at the backup TMC location.	1	Demo
SYS-260.1	PR-SYS-4	The backup TMC location shall be maintained with current versions of all software and operational data to support operations in the event of a catastrophic failure at the primary TMC location.	1	Demo
SYS-260.1.1	PR-SYS-4	The backup TMC location shall require no more than 15 minutes maintenance time to become operational.	1	Demo
SYS-270	OR-DDM-19	CapTOP or related third party software shall provide Maintenance Staff with a function to test and diagnose device/equipment problems remotely.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SYS-280	UR-TO-30	CapTOP or related third party software shall provide System Administrator and Maintenance Manager access to troubleshooting functions to diagnose problems with the following: a. ITS field devices; b. CapTOP database; c. workstation and server performance; d. network performance.	1	Demo

3.2 Database Requirements

3.2.1 Database Architecture Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DBA-10	SR-SYS-1, SR-SYS-2, OR-DWA-1	CapTOP shall provide a client-server based Relational Database Management System (RDBMS) with the following architectural features: a. SQL command line interface; b. application program interface; c. scalable in terms of number of users and database size; d. support for RAID 0-5; e. support for symmetric multi-processing; f. comprehensive reporting functions.	C	Demo
DBA-10.1	SR-SYS-1, SR-SYS-2	CapTOP shall utilize a COTS-based RDBMS to support the following data management implementations: a. simple data marts that gather data from ITS devices and equipment to serve TMC manager/operators; b. data warehouses that collect, integrate, and summarize transportation data.	2	Demo
DBA-10.2	SR-SYS-1, SR-SYS-2, OR-DWA-2, OR-DWA-2	The CapTOP RDBMS shall provide an ANSI standard SQL database engine to support interoperability with other third party applications.	C	Demo
DBA-10.3	SR-SYS-1, SR-SYS-2, OR-DWA-2	The CapTOP RDBMS shall support multi-users and simultaneous access.	C	Demo
DBA-10.3.1	SR-SYS-1, SR-SYS-2	The CapTOP RDBMS shall support up to 30 simultaneous connections from a combination of system applications and users without affecting its performance.	1	Demo
DBA-10.4	SR-SYS-30	The CapTOP RDBMS shall support local or remote access by applications or users.	C	Demo
DBA-10.5	OR-SMM-10, OR-DWA-2	The CapTOP RDBMS shall provide backup and recovery data management support.	1	Demo
DBA-10.6	OR-DWA-2	The CapTOP RDBMS shall have the ability to support database diagnostics.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DBA-10.7	OR-DWA-2	The CapTOP RDBMS shall have the capability to support data archiving.	1	Demo
DBA-10.8	SR-SYS-1, SR-SYS-2	All CapTOP subsystems/applications shall use the configurable parameters for connecting to the database, without the need to change source code: a. engine-name (if applicable); b. database name; c. connection name; d. username; e. password; f. IP address/port # of database (if applicable).	1	Demo
DBA-20	OR-DWA-1	The CapTOP database system shall consist of the following databases: a. operations database; b. archive database; c. configuration database; d. log database; e. GIS database. Refer to the Database Summary **Error! Reference source not found.** below for more information.	C	Demo
DBA-20.1	OR-TDCA-21	The operations database shall store and manage the following data required for CapTOP operation: a. ITS device status (refer to CDB-10.1 for the list); b. DMS and HAR message libraries; c. DMS, PDMS, and HAR message history; d. travel time data; e. aggregated traffic data (speed weighted by volume (where possible), volume summed, occupancy averaged, and classification summed)); f. incident data (refer to definition of "incident" in the definition section of this document); g. pre-defined incident response plans; h. executed incident response plans; i. measures of effectiveness (refer to INM-360.2 for list).	All core functions "C", except items d, e, and i are priority 1	Demo
DBA-20.2	OR-DWA-1	The configuration database shall store and manage the following CapTOP system configuration information: a. user roles/groups and access/privilege data; b. system/subsystem configuration data; c. database configuration data; d. ITS device configuration change history; e. ITS device configuration data.	C	Demo
DBA-20.2.1	OR-DWA-1	CapTOP shall provide an automated capability to initialize the CapTOP system and load the configuration data using an initial boot file or other mechanism (also refer to DBA-10.8).	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DBA-20.3	OR-DWA-1, OR-DDM-21	The log database shall store and manage the following CapTOP logged data: a. system events: i. application startup; ii. application shutdown; iii. open database connection; iv. close database connection; v. user-invoked database transactions (query, modifications); b. system warnings, errors and alarms; c. operator events.	C	Demo
DBA-20.4	OR-DWA-13	The archive database shall store the data archived from the following databases: a. operations database; b. configuration database; c. log database.	C	Demo
DBA-20.5	OR-DWA-1	The GIS database shall store and manage geo-referenced data. Refer to GUI-120.1.1 for additional information.	C	Demo

A summary of the databases, including the data types, the source of data, and the real time storage location are shown in **Error! Reference source not found.**below.

TABLE 6 Database Summary

Database Summary Table			
#	**Data Types**	**Source**	**Real-Time Storage Location**
1.	ITS Device Configuration Change History	CapTOP	CapTOP Configuration Database
2.	ITS Device Configuration Data	CapTOP	
3.	User Account, Roles/Groups, and Access Privilege Data	CapTOP	
4.	System/Subsystem Configuration Data	CapTOP	
5.	GIS Configuration Change History	CapTOP	CapTOP GIS Database
6.	GIS Data	CapTOP	
7.	Operator Log	CapTOP	CapTOP Log Database
8.	System Alerts	CapTOP	
9.	System Log	CapTOP	
10.	Incident Data	CapTOP	CapTOP Operations Database
11.	Incident Alerts	CapTOP	
12.	CCTV Status	CapTOP	
13.	DMS/PDMS Message History	CapTOP	
14.	DMS/PDMS Message Library	CapTOP	
15.	DMS/PDMS Status	CapTOP	
16.	Executed Incident Response Plans	CapTOP	
17.	HAR Message History	CapTOP	
18.	HAR Message Library	CapTOP	
19.	HAR Status	CapTOP	
20.	Measures of Effectiveness	CapTOP	
21.	Pre-Defined Incident Response Plans	CapTOP	

Database Summary Table			
#	**Data Types**	**Source**	**Real-Time Storage Location**
22.	Travel Time Data	INRIX (INRIX Data Server)	CapTOP Operations Database (Traffic Data Server)
23.	Speed	INRIX Sensors (INRIX Data Server)	
24.	SpeedInfo Station Status	SpeedInfo Sensors (SpeedInfo Data Server)	
25.	Speed	SpeedInfo Sensors (SpeedInfo Data Server)	
26.	Traffic Detection Station Status	Traffic Detection Station Server	
27.	Speed, Volume, Occupancy	Traffic Detection Station Server	
28.	Traffic.com Station Status	Traffic.com Sensors (Traffic.com Data Server)	
29.	Speed, Volume, Occupancy	Traffic.com Sensors (Traffic.com Data Server)	
30.	Permanent Count Station Status	Permanent Count Stations (PCS Data Server)	
31.	Speed, Volume, Occupancy, Classification	Permanent Count Stations (PCS Data Server)	
32.	WIM Status	CVISN (Roadside Operations Computer)	CapTOP Operations Database, Roadside Operations Computer
33.	WIM Data	CVISN (Roadside Operations Computer)	
34.	RWIS Status	SCAN Web (SCAN Web Database)	CapTOP Operations Database and RWIS Server
35.	RWIS Data	SCAN Web (SCAN Web Database)	
36.	170E Traffic Signal Status Data	QuicNet (QuicNet Signal System Database)	CapTOP Operations Database and QuicNet Signal System Database
37.	170E Traffic Signal Plan Data	QuicNet	QuicNet Signal System Database Only
38.	Video Recordings	CapTOP	DVR
39.	ATC Traffic Signal Status Data	ATC Signal System Database	CapTOP Operations Database and ATC Signal System Database (future)
40.	ATC Traffic Signal Plan Data	ATC Signal System Database	ATC Signal System Database Only(future)

3.2.2 GIS Database Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GDB-10	OR-DWA-1	CapTOP shall utilize a COTS GIS package for the storage and retrieval of CapTOP geo-referenced data compatible with DDOT and District of Columbia practices.	C	Demo
GDB-20	OR-DWA-1, OR-IM-5	CapTOP shall be capable of referencing location-related alphanumeric data to spatial data via GIS geocoding.	C	Demo
GDB-30	IR-GUI-2	The GIS spatial data used in CapTOP shall conform to DDOT's GIS standards to allow for seamless information exchange with citywide spatial databases.	C	Demo
GDB-30.1	IR-GUI-6, OR-DWA-1	The GIS database shall allow users the ability to add, edit, delete, import, and export geo-referenced map data related to ITS-specific information, subject to	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		privilege level.		
GDB-30.2	IR-GUI-6, OR-DWA-1	CapTOP shall be able to import ARC/GIS formatted shape files and display as a separate layer on the CapTOP map display.	C	Demo
GDB-40	OR-DWA-1	The GIS database shall store and maintain the link-node street network layer to enable connectivity with streets and intersections having relationships with each other.	C	Demo
GDB-40.1	OR-DWA-1	The GIS database shall support dynamic segmentation.	C	Demo
GDB-40.2	OR-DWA-1	The GIS database shall support milepost referencing for freeways and street address referencing for arterials.	C	Demo
GDB-40.3	OR-DWA-1	The link-node network layer will include definition of both links and nodes.	C	Demo
GDB-40.3.1	OR-DWA-1	Nodes will represent specific locations in citywide spatial databases, be defined for each link endpoint, and will include the following data at a minimum: a. Node ID (required) b. Node location in latitude/longitude (required) c. Roadway name(required) d. Cross street name (optional) e. Description (optional)	C	Demo
GDB-40.3.2	OR-DWA-1	Links will be defined between nodes and will include the following data at a minimum: a. Link ID (required) b. Starting Node ID (required) c. Ending Node ID (required) d. Corresponding roadway segment in roadway layer (required) e. Description (optional)	C	Demo
GDB-60	IR-GUI-10	The GIS database shall be able to turn on/off the display of various GIS-managed layers, each with associated real-time status data (refer to GUI-120.1.1).	C	Demo
GDB-60.1	IR-GUI-10	Each ITS subsystem shall have its own icon layer.	1	Demo
GDB-70	OR-DWA-1	CapTOP shall only allow the System Administrator and Database Administrator to add new tables and GIS layers to the GIS database.	C	Demo
GDB-80	OR-DWA-1	CapTOP shall only allow the System Administrator and Database Administrator to add and modify the attributes in the GIS database.	C	Demo

3.2.3 Log Database Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
LOG-10	UR-TO-11	CapTOP shall store and time stamp operator and system activities and provide the output in a time sequential log. Refer to LOG-10.4 and each subsystem's logging requirements for more information.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
LOG-10.1	UR-TO-11	For log entries triggered by user actions, CapTOP shall store the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the device ID, description of action, and summary status of device).	C	Demo
LOG-10.2	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall store the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action (include the device ID, command type and status of device prior to transmission).	C	Demo
LOG-10.3	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all activities: a. operator input; b. operator command transmission; c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.	C	Demo
LOG-10.4	UR-TO-11, OR-DDM-21	CapTOP shall have the capability to automatically log the following system activities to the log database: a. any system-initiated action that attempts to, or results in, a change to any device; b. any system-initiated action that attempts to, or results in, a change to any data in the system; c. when any communication status for any device changes (OK to failed, and failed to OK); d. changes in online-offline mode for any device; e. when any device changes status (OK to failed, and failed to OK); f. all transmitted alerts sent by the system; g. any system error, alarm, or warning; h. user login; i. user logout; j. software application login; k. software application logout; l. database login;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		m. database logout. Refer to each subsystem's logging requirements for more information.		
LOG-20	UR-TO-11	CapTOP shall log the following configuration activities: a. device configuration updates (refer to each subsystem for configuration data); b. database configuration updates (database name, field names, data types, keys, indexes); c. system configuration updates (user accounts, roles/groups, access privileges, system/subsystem configuration data).	C	Demo
LOG-20.1	UR-TO-11	CapTOP shall log the following database configuration updates: a. configuration updates to any table or field within a table; b. configuration changes to any predefined queries; c. configuration changes to any predefined reports.	C	Demo
LOG-30	OR-IM-38	CapTOP shall be able to automatically store the log of the operator's shift-handover that records open actions for the next shift. Refer to INM-90 for more information.	C	Demo
LOG-30.1	OR-IM-38	CapTOP shall provide a simple report to show the contents of the shift-handover log for each shift that can be generated for a specified time period including start and end time and that can be selected for a specific operator or sorted by operator.	1	Demo
LOG-40	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	C	Demo
LOG-50	OR-DWA-13	CapTOP or related third party software shall have the capability to format and perform automated and manually initiated migration of logged data from log database to archive database.	1	Demo
LOG-50.1	OR-DWA-13	The time interval for archiving logged data shall be configurable.	1	Demo
LOG-60	OR-DOC-9, OR-DWA-5, OR-IM-59	CapTOP shall have the capability to query the log data based on the following parameters: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Application name; g. Action type; h. Description of action (include the device ID, command type and status of device prior to transmission). i. Any keyword on any field;	1	Demo

3.2.4 Configuration Database Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CDB-10	SR-SYS-6	CapTOP shall provide a configuration database to store, retrieve, and display system and subsystem configuration information. Refer to GUI-200.1, GUI-290, and each subsystem for more information.	C	Demo
CDB-10.1	OR-TDCA-21	The configuration database shall store, retrieve, and display the parameters to set up, control, and communicate with the following field devices: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations (CapTOP to server configuration only; field configuration stored in remote SpeedInfo server); d. Traffic.com Stations (CapTOP to server configuration only; field configuration stored in Traffic.com server); e. CCTV; f. HAR; g. DMS/PDMS; h. 170E Traffic Signals; i. ATC Traffic Signals; j. Lane Control Signs; k. Blank-Out-Signs; l. WIM Stations; m. RWISs.	C, items i, l, and m priority 2	Demo
CDB-20	UR-TO-28	CapTOP shall provide the System Administrator and Database Administrator the capability to store, retrieve, and display user account and group membership information. Refer to GUI-330* and GUI-340* for more information.	C	Demo
CDB-30	OR-SMM-9	CapTOP shall provide data validation routines that are automatically invoked prior to the data being stored in the configuration database.	1	Demo
CDB-30.1	OR-SMM-9	CapTOP shall support the following types of data validation on the configuration database: a. data format check on field types; b. data range checks with configurable limits; c. data context checks.	1	Demo
CDB-30.2	OR-SMM-9	CapTOP shall enforce mandatory validation for any updates to the configuration database.	1	Demo
CDB-30.3	OR-SMM-9	CapTOP shall provide a GUI to display all identified invalid configuration data for users correction.	1	Demo
CDB-30.4	OR-SMM-9	The configuration database shall not be updated until all configuration data passes validation.	1	Demo
CDB-40	SR-SYS-6	The configuration database shall support versioning by providing master and business versions (logical copies) of the database for privileged users.	1	Test
CDB-40.1	SR-SYS-6	The configuration database shall provide a master	1	Test

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		version as the default version.		
CDB-40.2	SR-SYS-6	The configuration database shall provide a business version (logical copy) of the database for each user, subject to privilege level.	1	Test
CDB-40.3	SR-SYS-6	The System Administrator and Database Administrator shall be permitted to promote (reconcile and incorporate edits) from the business version (logical copy) of configuration database to the master version.	1	Test
CDB-40.4	SR-SYS-6	Only the System Administrator and Database Administrator shall be able to edit the master version of the configuration database.	1	Test
CDB-40.5	SR-SYS-6	The master version of the configuration database shall be used for operations, archival, recovery, and major editing.	1	Test

3.2.5 Operations Database Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
ODB-10	UR-TO-25, IR-GUI-26, IR-GUI-16	CapTOP shall provide an operations database to store, retrieve, and display system and subsystem operational information.	C	Demo
ODB-10.1	UR-TO-25, IR-GUI-26, IR-GUI-16	CapTOP shall provide an operations database to store, retrieve, and display real-time status information for the following devices: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations; d. Traffic.com Stations; e. CCTV; f. HAR; g. DMS/PDMS; h. 170E Traffic Signals; i. ATC Traffic Signals; j. Lane Control Signs; k. Blank-Out-Signs; l. WIM Stations; m. RWISs. Refer to each subsystem for additional details.	C, items i and l priority 2	Demo
ODB-20	UR-TO-25, IR-GUI-26, IR-GUI-16	CapTOP shall provide an operations database to store, retrieve, and display real-time status and operational information for the following types of data: a. incident data, including incident response plans; b. traffic condition data; c. video cameras information (excluding video images and streams); d. roadway weather information; e. regional weather information; f. DMS and HAR message libraries; g. DMS, PDMS, and HAR message history;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		h. travel time data; i. measures of effectiveness; Refer to INM-30.2.1, INM-100, INM-580, INM-360, RWI-30.2., RWI-20, CCT-30.2.1, CCT-40, DMS-270, DMS-280, HAR-260, HAR-270, SYS-170, HAR-250, SIG-180, RWI-120, GUI 150 and each subsystem for additional details.		
ODB-30	OR-SMM-9	CapTOP shall provide data validation routines that are automatically invoked prior to the data being stored in the operations database.	1	Demo
ODB-30.1	OR-SMM-9	CapTOP shall support the following types of data validation on the operations database: a. data format check on field types; b. data range checks with configurable limits; c. data context checks.	1	Demo
ODB-30.2	OR-SMM-9	CapTOP shall enforce mandatory validation for any updates to the operations database.	1	Demo
ODB-30.3	OR-SMM-9	CapTOP shall provide a GUI to display invalid operations data initiated by user action for correction by the operator.	1	Demo
ODB-30.4	OR-SMM-9	The operations database shall not be updated until all operations data initiated by user action passes validation.	1	Demo
ODB-30.5	OR-SMM-9	CapTOP shall generate alerts for data failing validation that are initiated by system action containing an identification of the field to be updated, value to be entered, and time of attempt. The data will be discarded and not entered into the operations database.	1	Demo
ODB-40	SR-SYS-6	The operations database shall support versioning by providing master and business versions (logical copies) of the database for privileged users.	1	Demo
ODB-40.1	SR-SYS-6	The operations database shall provide a master version as the default version.	1	Demo
ODB-40.2	SR-SYS-6	The operations database shall provide a business version (logical copy) of the database for each user, subject to privilege level.	1	Demo
ODB-40.3	SR-SYS-6	The System Administrator and Database Administrator shall be permitted to promote (reconcile and incorporate edits) from the business version (logical copy) of operations database to the master version.	1	Demo
ODB-40.4	SR-SYS-6	Only the System Administrator and Database Administrator shall be able to edit the master version of the operations database.	1	Demo
ODB-40.5	SR-SYS-6	The master version of the operations database shall be used for operations, archival, recovery, and major editing.	1	Demo
ODB-50	OR-DWA-1	The operational database shall store the following traffic conditions data with roadway location information: a. volume; b. speed; c. occupancy;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		d. incident data; e. roadway weather data; f. travel times along pre-defined routes.		

3.2.6 Archive Database Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
ADB-10	OR-DWA-13	CapTOP shall provide a secure archive database to store, retrieve, and display historical data that may be needed for future reference.	C	Demo
ADB-10.1	OR-DWA-13	The archive database shall be structured to accept data from all the tables that exist in the following databases for the purpose of storing archive data: a. operations database; b. configuration database; c. log database.	C	Demo
ADB-10.1.1	OR-DWA-13	The CapTOP archive database shall be able to store and manage the following data: a. historical incident data; b. historical traffic data that has been aggregated, calculated or derived; c. ITS device status; d. DMS/PDMS message history; e. HAR recording history; f. historical configuration change history data; g. historical GIS configuration change history data; h. historical operator log data; i. historical system log data; j. historical signal status. Refer to the **Error! Reference source not found.**Archiving Requirements Summary below and also each subsystem's archiving requirements for more information.	C	Demo
ADB-10.2	OR-SMM-9	The archive database shall store archived data with the following information: a. date/time stamp; b. source of data.	C	Demo
ADB-20	OR-DWA-12	CapTOP shall provide metadata for the archive database.	2	Demo
ADB-20.1	OR-DWA-12	The metadata shall have attributes that describe the source, type, and quality of the archived data.	2	Demo
ADB-20.2	OR-DWA-12	CapTOP shall support both metadata generated by the system and metadata entered manually.	2	Demo

TABLE 7 Archive Requirements Summary

#	Data Types	Source	Need to Archive (Yes or No)	Comment
1	Speed, Volume, Occupancy, Classification	DDOT Permanent Count Stations (Video, IR, Acoustic)	Yes - Not raw, aggregated only	Raw data coming from sensors or servers is not required to be archived. CapTOP shall archive only aggregated, derived and calculated data.
2	Speed, Volume, Occupancy	DDOT Traffic Detection Stations (sensor type is TBD)	Yes - Not raw, aggregated only	Raw data coming from sensors or servers is not required to be archived. CapTOP shall archive only aggregated, derived and calculated data.
3	Speed, Volume, Occupancy	Traffic.com sensors	Yes - Not raw, aggregated only	CapTOP interface is direct with Traffic.com server. No need to archive raw data. Will be managed by vendor. CapTOP shall archive only aggregated, derived and calculated data.
4	Speed	SpeedInfo sensors	Yes - Not raw, aggregated only	CapTOP interface is direct with SpeedInfo server. No need to archive raw data. Will be managed by vendor. CapTOP shall archive only aggregated, derived and calculated data.
5	Average Speed, Freeflow Speed	INRIX sensors	Yes - Not raw, aggregated only	CapTOP interface is direct with INRIX server. No need to archive raw data. Will be on tape backup. Will be managed by vendor. CapTOP shall archive only aggregated, derived and calculated data.
6	170E Traffic Signal Status Data	QuicNet	Yes – dynamic operational status only	CapTOP shall archive this data. The signal status from QuicNet are stored in operations database first and then archived for one year period. QuicNet does not store this information.
7	170E Traffic Signal Plan Data	QuicNet	No	No need to archive data. Done by QuicNet.
8	ATC Traffic Signal Status Data	ATC Signal System	Yes – dynamic operational status only	CapTOP shall archive this data. The signal status from the ATC Signal System are stored in operations database first and then archived for one year period.
9	ATC Traffic Signal Plan Data	New Traffic Signal System	No	No need to archive data. Done by the ATC Signal System
10	WIM Data	CVISN	No	No need to archive data, unless calculated, but currently no requirement to calculate.
11	Incident Data	CapTOP	Yes	CapTOP shall archive this data.
14	Video Recordings	CapTOP	No	Archive of video data not desired
15	System Errors, Warnings, Alerts	CapTOP	Yes	CapTOP shall archive this data.
16	System Log	CapTOP	Yes	CapTOP shall archive this data.
17	Operator Log	CapTOP	Yes	CapTOP shall archive this data.
18	RWIS Data	SCAN Web	Yes	CapTOP shall archive this data. Note: This data is stored in SCAN Web, but is difficult to access thus CapTOP shall archive.
19	RWIS Status	SCAN Web	Yes	CapTOP shall archive this data.
20	DMS/PDMS Status	CapTOP	Yes	CapTOP shall archive this data.
21	DMS/PDMS Message	CapTOP	Yes	CapTOP shall archive this data.

#	Data Types	Source	Need to Archive (Yes or No)	Comment
	History			
22	CCTV Status	CapTOP	Yes	CapTOP shall archive this data.
23	HAR Status	CapTOP	Yes	CapTOP shall archive this data.
24	HAR Message History	CapTOP	Yes	CapTOP shall archive this data. CapTOP shall archive the text msg, and the audio file in .wav or other standard format.
25	Permanent Count Station Status	CapTOP	Yes	CapTOP shall archive this data.
26	Traffic Detection Station Status	CapTOP	Yes	CapTOP shall archive this data.
27	Pre-Defined Response Plans	CapTOP	Yes	CapTOP shall archive these data.
28	Executed Response Plans	CapTOP	Yes	CapTOP shall archive this data.
29	Measures of Effectiveness	CapTOP	Yes	CapTOP shall archive this data.
30	ITS Device Configuration Data	CapTOP	No	No need to archive this information.
31	ITS Device Configuration Change History	CapTOP	Yes	CapTOP shall archive who changed, when and why, as well as the old and new values.
32	User Account, Roles/Groups, and Access Privilege Change History	CapTOP	Yes	CapTOP shall archive who changed, when and why, as well as the old and new values.
33	System/Subsystem Configuration Change History	CapTOP	Yes	CapTOP shall archive who changed, when and why, as well as the old and new values.
34	GIS Data	CapTOP	No	No need to archive data. This is static data only, such as: street network, water bodies, buildings, parks, and device location data.
35	GIS Configuration Change History	CapTOP	Yes	CapTOP should archive who changed, when and why, but not the data. The data will be in the GIS database.
36	Travel Time Data	CapTOP	Yes	CapTOP shall archive this data. Route-specific travel time data that is calculated by CapTOP shall be archived. If coming from INRIX, the raw data is already archived on the INRIX data server, so not necessary for CapTOP to duplicate.

3.2.7 Database Report Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DBR-10	SR-SYS-22, OR-PM-2	CapTOP shall provide comprehensive reporting capabilities to support system operations and performance measurement.	2	Demo
DBR-10.1	SR-SYS-22	CapTOP or related third-party software shall provide the capability to query and format data from the database management system and provide as input into	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		various reports.		
DBR-10.2	SR-SYS-22	CapTOP shall provide predefined reports.	C	Demo
DBR-10.3	SR-SYS-22	CapTOP shall provide parameterized reports.	C	Demo
DBR-10.4	SR-SYS-22	CapTOP or related third-party software shall provide an *ad-hoc* report capability.	2	Demo
DBR-10.5	SR-SYS-22	CapTOP or related third-party software shall provide a GUI to customize reports by allowing the operator to customize both the query and the format of data.	2	Demo
DBR-10.6	SR-SYS-22	CapTOP or related third-party software shall store previously built custom reports.	2	Demo
DBR-10.7	SR-SYS-22	CapTOP or related third-party software shall provide the capability to store preformatted or predefined queries.	2	Demo
DBR-10.8	SR-SYS-22	CapTOP and related third-party software (if used) shall provide the capability to sort on any field in tabular-based report for workstation display or printing.	2	Demo
DBR-10.9	SR-SYS-22	CapTOP or related third-party software shall include a COTS-based, easy to use, report writing tool.	2	Demo
DBR-20	SR-SYS-22	CapTOP and related third-party software (if used) shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format, including at least bar charts and pie charts; c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	2	Demo
DBR-30	OR-PM-1, OR-PM-4, OR-PM-6, OR-PM-2	CapTOP shall have the capability to produce ITS device performance measurement reports over a specified time period.	2	Demo
DBR-30.1	OR-PM-1, OR-PM-4, OR-PM-6, OR-PM-2	CapTOP shall have the capability to produce DMS/PDMS subsystem performance reports using the following performance measures: a. Availability of DMS (mean operational time); b. Mean Time Between Failures (MTBF); c. Mean Time To Repair (MTTR).	2	Demo
DBR-30.2	OR-PM-1, OR-PM-4, OR-PM-6	CapTOP shall have the capability to produce CCTV subsystem performance reports using the following performance measures: a. Availability of CCTV (mean operational time); b. Mean Time Between Failures (MTBF); c. Mean Time To Repair (MTTR).	2	Demo
DBR-30.3	OR-PM-1,	CapTOP shall have the capability to produce HAR	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-PM-4, OR-PM-6	subsystem performance reports using the following performance measures: a. Availability of HAR (mean operational time); b. Mean Time Between Failures (MTBF); c. Mean Time To Repair (MTTR).		
DBR-30.4	OR-PM-1, OR-PM-4, OR-PM-6	CapTOP shall have the capability to produce RWIS subsystem performance reports using the following performance measures: a. Availability of RWIS (mean operational time); b. Mean Time Between Failures (MTBF); c. Mean Time To Repair (MTTR).	2	Demo
DBR-30.5	OR-PM-1, OR-PM-4, OR-PM-6	CapTOP shall have the capability to produce traffic detection station subsystem performance reports using the following performance measures: a. Availability of traffic detection stations (mean operational time); b. Mean Time Between Failures (MTBF); c. Mean Time To Repair (MTTR).	2	Demo
DBR-30.6	OR-PM-1, OR-PM-4, OR-PM-6	CapTOP shall have the capability to produce permanent count station subsystem performance reports using the following performance measures: a. Availability of permanent count stations (mean operational time); b. Mean Time Between Failures (MTBF); c. Mean Time To Repair (MTTR).	2	Demo
DBR-40	OR-DWA-5, OR-SEPM-3, OR-TOM-1, OR-TOM-2	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; j. number of Operator DMS/PDMS messages approved; k. number of Operator HAR recordings rejected; l. number of incidents opened (moved to “active” or “reopened”) by an Operator; m. number of incidents closed (ended, deleted,	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		cancelled, postponed) by an Operator.		
DBR-50	UR-TO-25, UR-TO-31, OR-TOM-2	CapTOP shall produce traffic management performance reports for the following performance measurements: a. travel times on a specified route over a specified time period; b. average speeds on a specified route over a specified time period; c. average volume on a specified route over a specified time period. d. accident rates on a specified route over a specified time period.	2	Demo
DBR-60	OR-DWA-7, OR-TOM-2	CapTOP shall be able to generate the following customized reports: a. list of system events sorted by type and date/time; b. a report showing the traffic measures of effectiveness (MOEs) over a specified time period; c. list of field device status sorted by subsystem and status; d. the number of failed communications sorted by subsystem over a specified time period.	2	Demo
DBR-70	OR-DOC-4, IR-GUI-8, SR-SYS-36, OR-TOM-2	CapTOP shall produce reports that list the location and status of the following field devices sorted by subsystem, device ID, location, and communication status: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations; d. Traffic.com Stations; e. CCTV; f. HAR; g. DMS/PDMS; h. 170E Traffic Signals; i. ATC Traffic Signals; j. Lane Control Signs; k. Blank-Out-Signs; l. WIM Stations; m. RWISs.	C	Demo
DBR-80	OR-DDM-12, OR-TOM-2	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. communication failures; c. signal controller failures.	2	Demo
DBR-90	OR-DDM-21	CapTOP shall produce a field device report to display the errors and alarms from any subsystem over a user-specified time interval.	C	Demo
DBR-100	OR-DOC-5	CapTOP shall produce reports for any ITS devices that have a command pending in the schedule/future event queue.	2	Demo
DBR-110	OR-TDCA-20	CapTOP shall produce device configuration reports for	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		the following ITS devices: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations; d. Traffic.com Stations; e. CCTV; f. HAR; g. DMS/PDMS; h. 170E Traffic Signals; i. ATC Traffic Signals; j. Lane Control Signs; k. Blank-Out-Signs; l. WIM Stations; m. RWISs.		
DBR-110.1	OR-TDCA-20	Each device configuration report shall list all configuration information stored in the database for a particular device. Refer to each subsystem for additional details.	C	Demo
DBR-120	UR-TO-11, OR-TID-3	CapTOP shall be able to support subsystem specific reports. Refer to the reports section of each subsystem for additional details.	2	Demo
DBR-130	OR-DDM-21	CapTOP shall provide a system alarm report, over a specified time period that provides the system alarm message text, and the date/time when displayed.	2	Demo
DBR-140	OR-DDM-29	CapTOP shall have the capability to query and report the following information on ITS devices: a. device ID; b. equipment type; c. model number; d. date purchased; e. serial number; f. original equipment manufacturer name, address, phone number, web address; g. seller's name, address, phone number, web address; h. warranty information; i. repair history.	C	Demo
DBR-150	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.	2	Demo
DBR-160	OR-SEPM-1, OR-IM-4	CapTOP shall provide a form for each table in the database to allow the Database Administrator to query, display, and print data.	2	Demo

3.2.8 Database Security Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DBS-10	SR-SYS-33	The CapTOP database shall support role-based	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		security policies for database access based on the CapTOP user group definitions. Refer to GUI-340.		
DBS-10.1	SR-SYS-33	The CapTOP database shall provide multiple security levels to control data access based on CapTOP user group definitions. Refer to GUI-340.3.2.	C	Demo
DBS-10.2	SR-SYS-33	CapTOP shall allow the System Administrator and Database Administrator to setup privileges on the database as a whole or on individual tables in the database.	C	Demo
DBS-10.2.1	SR-SYS-33	CapTOP shall allow database access rights to be configured on a per group and per table basis and shall default to the values shown in **Error! Reference source not found.** "Default Database Access Rights" below.	C	Demo
DBS-10.3	SR-SYS-33	All database access shall be user ID and password controlled.	C	Demo
DBS-20	SR-SYS-33	CapTOP shall maintain statistical data on attempted unauthorized accesses and provide e-mail notifications to the Database Administrator and TMC Manager whenever an attempted unauthorized access occurs.	1	Demo

TABLE 8 Default Database Access Rights

	DB Access Rights (R=Read, W=Write, RW=Read/Write)										
Data	DB Name	System Administrator/ DB Administrator	TMC Manager	TMC Operator	Maintenance Manager	Maintenance Technician	ROP Manager	ROP Driver	Transportation Planner	Traffic Engineer	Guest
ITS Device Configuration Change History	Configuration DB	RW	R	R	RW	R	R	R	R	R	R
ITS Device Configuration Data	Configuration DB	RW	RW	R	RW	R	R	R	R	R	R
User Account Roles/Groups, and Access Privileg Data	Configuration DB	RW	R	R	R	R	R	R	R	R	R
GIS Configuration Change History	GIS DB	RW	R	R	R	R	R	R	R	R	R
GIS Static Data	GIS DB	RW	RW	R	R	R	R	R	R	R	R
GIS Static User Data (e.g., incident icons)	GIS DB	RW	RW	RW	RW	R	R	R	R	R	R
Incident Log Data	Log DB	RW	R	R	R	R	R	R	R	R	R
Operator Log	Log DB	RW	R	R	R	R	R	R	R	R	R
Special Event Log Data	Log DB	RW	R	R	R	R	R	R	R	R	R
System Alerts	Log DB	RW	R	R	R	R	R	R	R	R	R
System Log	Log DB	RW	R	R	R	R	R	R	R	R	R
Work Zone Data	Log DB	RW	R	R	R	R	R	R	R	R	R
CCTV Status	Operations DB	RW	R	R	R	R	R	R	R	R	R
DMS/PDMS Message History	Operations DB	RW	R	R	R	R	R	R	R	R	R
DMS/PDMS Message Library	Operations DB	RW	RW	R	R	R	R	R	R	R	R
DMS/PDMS Status	Operations DB	RW	R	R	R	R	R	R	R	R	R

	DB Access Rights (R=Read, W=Write, RW=Read/Write)										
Data	DB Name	System Administrator/ DB Administrator	TMC Manager	TMC Operator	Maintenance Manager	Maintenance Technician	ROP Manager	ROP Driver	Transportation Planner	Traffic Engineer	Guest
Executed Response Plans	Operations DB	RW	R	R	R	R	R	R	R	R	R
HAR Message History	Operations DB	RW	R	R	R	R	R	R	R	R	R
HAR Message Library	Operations DB	RW	RW	R	RW	R	R	R	R	R	R
HAR Status	Operations DB	RW	R	R	R	R	R	R	R	R	R
Incident Data	Operations DB	RW	RW	RW	RW	R	R	R	R	R	R
Measures of Effectiveness	Operations DB	RW	R	R	R	R	R	R	R	R	R
Permanent Count Station Status	Operations DB	RW	R	R	R	R	R	R	R	R	R
Pre-Defined Response Plans	Operations DB	RW	RW	R	R	R	R	R	R	R	R
RWIS Status	Operations DB	RW	R	R	R	R	R	R	R	R	R
Special Event Data	Operations DB	RW	RW	RW	RW	R	R	R	R	R	R
Traffic Detection Station Status	Operations DB	RW	R	R	R	R	R	R	R	R	R
Travel Time Ddata	Operations DB	RW	R	R	R	R	R	R	R	R	R
WIM Status	Operations DB	RW	R	R	R	R	R	R	R	R	R
Speed, Volume, Occupancy, Classification	Operations DB	RW	R	R	R	R	R	R	R	R	R
170E Traffic Signal Status Data	Operations DB	RW	R	R	R	R	R	R	R	R	R
ATC Traffic Signal Status Data	Operations DB	RW	R	R	R	R	R	R	R	R	R
Archive Data	Archive DB	RW	R	R	R	R	R	R	R	R	R

3.2.9 Database Backup and Failure Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DBF-10	OR-SMM-10, PR-SYS-6, PR-SYS-7	CapTOP shall have a primary and mirrored database to minimize the probability and impact of database failures.	2	Demo
DBF-10.1	OR-DWA-2, OR-SMM-10, PR-SYS-7	CapTOP shall support a database mirroring capability to perform database failovers from the primary database to the mirrored database on the backup server.	2	Demo
DBF-10.2	PR-SYS-4	CapTOP shall have the capability to mirror the configuration, log, GIS, and operations databases to minimize the impact of disk failures and database failures.	2	Demo
DBF-10.3	PR-SYS-4	CapTOP shall have the capability to recover data from mirrored databases when failure is detected.	2	Demo
DBF-10.4	PR-SYS-4	CapTOP shall mirror all databases, except the archive database.	2	Demo
DBF-10.4.1	PR-SYS-4, PR-SYS-6	CapTOP shall have the capability to recover from database server failures within 10 seconds by failing over to mirrored database servers that are kept up to date with the database information.	2	Demo
DBF-10.5	PR-SYS-4	CapTOP shall maintain a database transaction log for use in recovering lost data.	2	Demo
DBF-10.6	PR-SYS-4, PR-SYS-6	CapTOP shall utilize the transaction log to restore the database to a last known state on a database failure.	2	Demo
DBF-20	OR-DWA-2, OR-SMM-10	CapTOP shall support a database backup capability to perform automated backups of the active databases to a storage device (disk, tape).	1	Demo
DBF-20.1	OR-DWA-2, OR-SMM-10	The backup capability shall allow System Administrator and Database Administrator to schedule automatic backups daily, weekly, and monthly.	1	Demo
DBF-20.2	OR-DWA-2, OR-SMM-10	The backup capability shall support System Administrator and Database Administrator initiated backups of active databases.	1	Demo
DBF-20.3	OR-DWA-2, OR-SMM-10	The backup capability shall allow System Administrator and Database Administrator initiate restoration of data from backup databases to active databases.	1	Demo
DBF-20.4	PR-SYS-4	CapTOP shall provide a verification process that checks the contents of the active database against the contents of the backup database.	1	Demo
DBF-20.5	PR-SYS-4	CapTOP shall continue operational functions without interruption during the performance of database backup and data migration functions.	1	Demo

3.2.10 Archiving, Warehousing, Mining Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DWA-10	OR-DWA-10	CapTOP shall maintain online accessibility of all archived information.	1	Demo
DWA-10.1	OR-DWA-11	CapTOP shall have the capability to transfer information from the archive database to the network accessible storage.	2	Demo
DWA-10.2	OR-DWA-14	CapTOP shall provide the necessary storage to archive the data for a minimum of 1 year.	1	Analyze
DWA-10.3	OR-DWA-14	CapTOP shall monitor utilization of allocated storage and send alerts to the System Administrator when configurable thresholds on usage have been reached.	1	Demo
DWA-20	OR-DWA-11	CapTOP shall utilize an enterprise RDBMS for the archive database.	1	Demo
DWA-20.1	OR-DWA-11	The enterprise RDBMS shall support data warehousing.	2	Demo
DWA-30	OR-DWA-18	CapTOP shall provide the data processing functions to clean, summarize, aggregate, and transform the incoming data before it is archived.	1	Demo
DWA-40	OR-DWA-20	CapTOP shall provide a data mining capability that allows users to query information contained within the archived data for the following purposes: a. determining incident patterns; b. determining recurrent congestion patterns; c. determining patterns with faulty equipment.	2	Demo
DWA-40.1	OR-DWA-20	As part of the data mining capability, CapTOP shall use data search capabilities and statistical algorithms to support *ad-hoc* queries to discover patterns and correlations in CapTOP data.	2	Demo
DWA-40.2	OR-DWA-20	CapTOP shall provide the capability to query and format archived data to feed the performance measures reports.	2	Demo
DWA-40.3	OR-DWA-20	As part of the data mining capability, CapTOP shall support ad-hoc queries to assist in discovery of patterns and correlations in CapTOP data.	2	Demo
DWA-50	OR-DWA-19	CapTOP shall be able to fuse different types of data from different sources together to enable queries across all data subjects in the data warehouse.	2	Demo
DWA-60	OR-DWA-22	CapTOP shall provide a reporting capability that produces predefined, customizable, and parameterized reports using archived data.	2	Demo
DWA-70	OR-DWA-21	CapTOP shall provide a user-friendly point-and-click query interface to acquire data using *ad-hoc* queries from the archive database.	2	Demo
DWA-80	OR-DWA-23	The reporting capability or related third party tool shall support complex *ad-hoc* queries that allow users to build and specify their own queries.	2	Demo
DWA-90	OR-DWA-24	CapTOP shall provide a GUI to display and print the processed data from archive database in tabular and graphical formats.	2	Demo
DWA-100	OR-DWA-16	CapTOP or related third party software shall have the capability to perform automated and manually initiated migration of data from the active database to archive	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		database. Refer to each subsystem's archiving requirements for more detail.		
DWA-100.1	OR-DWA-15	CapTOP shall provide the ability to configure the time interval for which the data moves from the active database to archive database.	1	Demo
DWA-100.2	OR-DWA-17	CapTOP shall provide a unique configurable parameter to define the time interval at which each different type of data is moved from the active database to the archive database.	1	Demo
DWA-100.3	OR-DWA-16	CapTOP shall archive data into the archive database at predefined levels of aggregation and summary.	1	Demo
DWA-110	OR-DWA-25	CapTOP shall have the capability to perform retrieval of data from the active database and the archive database.	C	Demo
DWA-110.1	OR-DWA-6	CapTOP shall allow users with appropriate privilege levels to retrieve data from the archive database.	C	Demo

3.3 Graphic User Interface Requirements

3.3.1 General GUI Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-10	SR-SYS-14	CapTOP shall provide a windows-based interface to access CapTOP subsystems, functions and data.	C	Demo
GUI-20	IR-GUI-1, SR-SYS-14	CapTOP shall incorporate the following types of displays: a. graphics-based displays; b. GIS-based map displays; c. web-based displays; d. alphanumeric text-based displays; e. form-based displays.	C	Demo
GUI-20.1	IR-GUI-50	CapTOP shall be able to incorporate the following GUI components in any of the CapTOP displays: a. windows; b. menus; c. toolbars; d. icons; e. graphical objects; f. dialog boxes; g. text labels; h. action buttons/controls; i. visual alarms; j. input fields; k. check boxes; l. radio buttons; m. audio alarms.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-20.2	IR-GUI-1	CapTOP displays shall have the capability to incorporate text and graphical objects with dynamic behavior.	C	Demo
GUI-20.3	IR-GUI-1	CapTOP displays shall have the capability to incorporate bmp, jpeg, png, tiff, and wmf files.	1	Demo
GUI-20.4	IR-GUI-1	CapTOP form-based displays shall have the capability to permit data entry, to invoke command functions, and to provide system response.	C	Demo
GUI-20.5	UR-TO-2	CapTOP shall provide error checks, range checks with configurable limits, and consistency checks of all operator input fields before the data is saved.	1	Demo
GUI-20.5.1	UR-TO-3	CapTOP shall provide consistency checks to ensure entries between fields are consistent based on programmed limitations.	1	Demo
GUI-20.5.2	UR-TO-3	CapTOP shall provide the ability to spell check any user input fields.	2	Demo
GUI-20.5.2.1	UR-TO-3	CapTOP shall highlight in RED any words with spelling errors in each field.	2	Demo
GUI-20.5.3	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	Demo
GUI-20.6	SR-SYS-30	CapTOP web-based windows shall allow users to access CapTOP from remote locations, subject to privilege level.	1	Demo
GUI-20.6.1	SR-SYS-31, IR-GUI-19	CapTOP shall provide a secure web-based interface to support remote access of CapTOP functions and data from outside the DDOT network, subject to privilege level.	1	Demo
GUI-20.6.2	IR-GUI-19	CapTOP shall support web security using HTTPS and Internet encryption mechanisms.	1	Demo
GUI-20.7	IR-GUI-7	CapTOP web-based windows shall be able to display geo-referenced map data in real-time.	1	Demo
GUI-20.8	IR-GUI-19	CapTOP web-based windows shall allow multiple users to simultaneously access CapTOP functions and data, subject to privilege level.	1	Demo
GUI-20.9	IR-GUI-8	CapTOP alphanumeric text-based displays shall be able to present text-based information results from data retrieval and query.	1	Demo
GUI-20.10	IR-GUI-37	CapTOP alphanumeric text-based displays shall be able to display events, alarms, and subsystem device status information.	1	Demo
GUI-20.11	IR-GUI-1	CapTOP window displays shall support the following buttons and dialog prompts: a. OK – acknowledges system messages; b. CANCEL - clears user entered fields or rejects system actions; c. SAVE - saves all data entered; d. APPLY – applies user changes to the system, but does not close the window; e. CLOSE - closes the current window.	1	Demo
GUI-20.12	IR-GUI-1	CapTOP displays shall have the capability to be printed.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-20.13	IR-GUI-1	CapTOP displays shall have the capability to support a print preview capability.	2	Demo
GUI-20.14	IR-GUI-1	CapTOP shall display an hour glass or progress bar whenever a complicated task is invoked that requires more than 2 seconds for system response.	2	Demo
GUI-20.15	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	Demo 1
GUI-20.16	UR-TO-9	The CapTOP GUI shall be designed to minimize the number of free form text fields (limited to where absolutely necessary) and maximize the number of fields that use check boxes, radio buttons and selections from pull-down lists.	1	Demo 1
GUI-20.16.1	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Closest Intersection/Interchange; g. Quadrant; h. Ward.	1	Demo
GUI-20.16.2	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
GUI-20.16.3	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field based on the user entered characters. This requirement applies only to those fields that use lookup tables.	2	Demo
GUI-20.16.4	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo
GUI-20.16.4.1	OR-IM-4	CapTOP shall send the System Administrator and the TMC Manager an e-mail with the subject set to “New Location Identified”, as well as the user name, and the data entered into the Other field in the e-mail message body.	1	Demo
GUI-30	IR-GUI-50	CapTOP shall provide the user interface components that support hierarchical menus, pull-down menus, and pop-up menus.	1	Demo
GUI-40	IR-GUI-19	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, with a minimum of 20 simultaneous users accommodated.	C	Demo

3.3.2 CapTOP Toolbar Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-50	IR-GUI-15	CapTOP shall allow users to perform all CapTOP functions under one common Graphical User Interface (GUI), using a standard set of control windows, pull-down menus, push-buttons, and mouse activated icons.	1	Demo
GUI-50.1	IR-GUI-50	CapTOP shall provide a toolbar with pull-down menus and icons to access all CapTOP subsystems, functions, data and applications from any CapTOP workstation.	1	Demo
GUI-50.1.1	IR-GUI-15, IR-GUI-51	CapTOP shall provide a user interface with a toolbar that provides access to the following subsystems, functions, data and applications via an icon on the toolbar and also via a toolbar drop-down menu: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations; d. Traffic.com Stations; e. CCTV; f. HAR; g. DMS/PDMS; h. RWISs; i. Regional Weather; j. StormTrak; k. Incident Management; l. Map Display/GIS; m. Traffic Signals; n. QuicNet 170E Central Software; o. ATC Software Central Software (future); p. Tools: I. Account Management; II. System Configuration; III. Online Users List; IV. Electronic White Board; V. Notification/Messaging; VI. Work Order Management (CityWorks); VII. Configuration Management Software; VIII. System Scheduler; IX. Event Display. Refer to subsystem requirements for additional details.	C, items i, j, and p priority 1, item o priority 2	Demo
GUI-60	IR-GUI-37	CapTOP shall support a system event window that can display all logged system events, system alarms, and operator events.	1	Demo
GUI-60.1	IR-GUI-37, UR-TO-12	The system event window shall display all events and alarms in a time sequential order.	1	Demo
GUI-60.2	IR-GUI-37	The system event display shall color code events and alarms as follows: a. informational event = text in black. b. warning event or alarm = text in orange; c. critical error event or alarm = text in red.	1	Demo
GUI-60.3	IR-GUI-37	The system event display shall use a small icon to distinguish events from alarms in the event display.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-60.4	IR-GUI-37, SR-SYS-19	The system event window shall display the following fields for event/alarm log entries triggered by user actions: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action.	C	Demo
GUI-60.4.1	IR-GUI-37, SR-SYS-20	The system event window shall be able to sort and filter on any of the fields in the above requirement.	1	Demo
GUI-60.5	IR-GUI-37	The system event window shall display the following fields for event/alarm log entries generated by the CapTOP applications: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
GUI-60.5.1	IR-GUI-37	The system event window shall provide the ability to sort and filter on any of the fields in the above requirement.	1	Demo
GUI-60.6	IR-GUI-37	CapTOP shall provide audible and visual popup alerts for events designated as system alarms.	1	Demo
GUI-60.6.1	IR-GUI-37	CapTOP shall allow the System Administrator to enable/disable the audible and visual popup alerts on a per user basis.	1	Demo
GUI-60.6.2	IR-GUI-37	CapTOP shall allow the System Administrator to enable/disable the audible and visual popup alerts on a per subsystem basis.	1	Demo
GUI-60.6.3	IR-GUI-37	CapTOP shall allow the System Administrator to enable/disable the audible and visual popup alerts on a per device basis.	1	Demo
GUI-60.6.4	IR-GUI-37	CapTOP shall provide audible and visual popup message alerts when a system/device status changes.	1	Demo
GUI-60.6.4.1	SR-SYS-17	CapTOP shall support an alarm capability, whereby the following events can be configured as different alarm types: a. Incident alerts; b. System warnings; c. System errors; d. Subsystem warnings; e. Subsystem failures; f. Schedule reminders; g. Device warnings; h. Device failures.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-60.6.4.2	SR-SYS-18	Each CapTOP alarm type shall be able to be configured for the following methods for notification: a. event display (including audible and visual characteristics); b. pop-up window (including audible and visual characteristics); c. e-mail message (including importance characteristics); d. text message; e. electronic notepad.	1	Demo
GUI-60.7	SR-SYS-21	CapTOP shall provide a search window to allow the user to search the following data for keywords or phrases: a. system events; b. system alarms; c. operator events; d. all of the above.	C	Demo
GUI-60.8	UR-TO-29	CapTOP shall allow the TMC Operators to view the following data for the current session: a. system event logs; b. error logs; c. user logs.	1	Demo
GUI-60.9	UR-TO-29	CapTOP shall allow the System Administrator to view the following data for any time period across multiple operator sessions: a. system event logs; b. error logs; c. user logs.	1	Demo
GUI-60.10	UR-TO-11	CapTOP shall provide the ability to save default window sizes and locations on a per user-basis.	1	Demo
GUI-60.11	OR-SMM-7	CapTOP shall provide the System Administrator unrestricted access to all system functions.	1	Demo
GUI-60.12	OR-DWA-22	CapTOP shall provide a query editor window to view, create, edit, and run data queries.	1	Demo
GUI-60.13	OR-DWA-21, OR-DWA-23	The query window shall support complex, ad hoc queries that allow users to build and specify their own queries.	1	Demo
GUI-60.14	SR-SYS-18	Unless noted otherwise, CapTOP shall use the following color coding conventions: a. green or black text or objects to indicate nominal values or informational messages; b. red to indicate critical information for items that require immediate attention; c. orange to indicate warnings for items that require attention.	1	Demo
GUI-60.15	SR-SYS-18	Unless noted otherwise, CapTOP shall use the following audible conventions: a. buzzer (configurable by System Administrator) to indicate critical information for items that require immediate attention; b. bell (configurable by System Administrator) to indicate warnings for items that require attention.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-70	IR-GUI-50	The CapTOP toolbar shall display the name of the user currently logged in at all times.	1	Demo
GUI-80	IR-GUI-50	The CapTOP toolbar shall display the current date/time of the system at all times.	1	Demo
GUI-90	IR-GUI-50	The CapTOP toolbar shall have a feature that allows the user to access a list of users currently logged into the system.	1	Demo

3.3.3 Map Display Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-110	IR-GUI-6	CapTOP shall provide a GIS-based map display window capability available from any CapTOP workstation.	C	Demo
GUI-110.1	IR-GUI-6	The CapTOP map display window shall be launched by the following methods: a. via a toolbar icon; b. via a toolbar menu item.	1	Demo
GUI-120	IR-GUI-6	The CapTOP map display window shall be able to display GIS-based geo-referenced data.	C	Demo
GUI-120.1	IR-GUI-25	CapTOP shall provide a map display window with geographically accurate maps of the following: a. Street network; b. Map utility layers; c. ITS devices; d. Incidents; e. Traffic condition data.	C	Demo
GUI-120.1.1	IR-GUI-12, IR-GUI-35, IR-GUI-46, IR-GUI-53, IR-GUI-54	The CapTOP map display shall allow users to turn on/off the following map layers independently, subject to privilege level: a. Street network (each a separate layer): I. interstates; II. regional main routes; III. arterials; IV. surface streets; V. residential streets. b. Map utility layers: I. parks; II. aerial photography; III. ward boundaries; IV. quadrant boundaries; V. parking restrictions; VI. WMATA subway routes*; VII. WMATA bus routes*; VIII. WMATA bus route status*; IX. Transit stations*; X. utility lines (power, gas, water, communication, sewage) XI. utility poles; XII. water bodies; XIII. buildings; XIV. bridges and tunnels;	All C, items with * are 2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		XV. manholes and conduit runs for power and communication to ITS devices*; XVI. truck routes*; XVII. truck routes with height restrictions*; XVIII. truck routes with weight restrictions*; XIX. points of interest. c. ITS devices (each a separate layer): I. Permanent Count Stations; II. Traffic Detection Stations; III. SpeedInfo Stations; IV. Traffic.com Stations; V. CCTV devices; VI. HAR devices; VII. DMS/PDMS devices; VIII. 170E Traffic Signal devices; IX. ATC Traffic Signal devices*; X. Lane Control Signals; XI. Blank-Out-Signs (BOS); XII. RWIS devices; XIII. AVL-tracked vehicles (ROPS, Maintenance Vehicles, Snow Trucks)*. d. Incidents (1 layer for all): I. Active construction/maintenance incidents; II. Active special events; III. Active traffic accidents; IV. Active road closures; V. Active "other" incident types. e. Traffic condition data.		
GUI-120.1.1.1	IR-GUI-12	CapTOP shall retain map layer selections on a per user basis, applying the selection at user login.	1	Demo
GUI-120.1.2	IR-GUI-25	The CapTOP map display shall be able to show the location of reversible lanes, one-way streets, evacuation routes, snow routes, and lane/turning restrictions.	C	Demo
GUI-120.1.2.1	OR-EM-6	CapTOP shall provide the TMC Operator with a map-based display to indicate which routes are operating in a reverse direction.	1	Demo
GUI-120.1.3	IR-GUI-33	The CapTOP map display window shall be able to display data from multiple sources on different map layers.	2	Demo
GUI-120.2	IR-GUI-25	CapTOP shall be able to display the street name on the map when the mouse hovers over a roadway link.	1	Demo
GUI-120.3	IR-GUI-25	CapTOP shall be able to display the intersection name on the map when the mouse hovers over a traffic signal controller icon.	1	Demo
GUI-120.4	IR-GUI-25	CapTOP shall be able to pan and zoom the map display.	1	Demo
GUI-120.4.1	IR-GUI-25	The zoom-in function shall be supported using a rubber-band style box, where the map will zoom into an area boxed in by the user.	1	Demo
GUI-120.4.2	IR-GUI-25	The user shall also be able to zoom in the map using a forward roll of the mouse wheel.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-120.4.3	IR-GUI-25	The user shall be able to zoom out the map using a reverse roll of the mouse wheel.	1	Demo
GUI-120.4.4	IR-GUI-25	The user shall also be able to zoom in the map by clicking on a "+" icon, and then clicking on the map display to zoom in one level centered on the location clicked.	1	Demo
GUI-120.4.5	IR-GUI-25	The user shall be able to zoom out the map by clicking on a "-" icon, and then clicking on the map display to zoom out one level centered on the location clicked.	1	Demo
GUI-120.4.6	IR-GUI-25	The user shall be able to pan the map display by clicking on a "pan" icon and then clicking on the map display while holding down the left mouse key while simultaneously moving the mouse in the direction desired to be panned.	1	Demo
GUI-120.4.7	IR-GUI-25	The map display shall allow the System Administrator to define what layers are visible at each zoom level.	1	Demo
GUI-130	IR-GUI-10, IR-GUI-12, IR-GUI-54, IR-GUI-55, IR-GUI-61, IR-GUI-36	The CapTOP map display shall provide geographically accurate device and incident icon locations for the following devices: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations; d. Traffic.com Stations; e. CCTV devices; f. HAR devices; g. DMS/PDMS devices; h. 170E Traffic Signal devices; i. ATC Traffic Signal devices; j. RWIS devices; k. Incident locations; l. WIM stations; m. AVL-tracked vehicles (for ROPS, Snow Trucks, and Maintenance Vehicles).	C, items j, l, and m priority1, items i and priority 2	Demo
GUI-130.1	IR-GUI-11	CapTOP shall display a location description for ITS devices based on location information provided by DDOT. Refer to each subsystem for details on location information for each ITS subsystem.	C	Demo
GUI-130.2	IR-GUI-27	CapTOP shall display the device icons spatially on the map displayed, based on their physical geographic location.	C	Demo
GUI-130.3	IR-GUI-27	CapTOP shall have the ability to display icons side-by-side whenever one (1) or more icons are located at exactly the same location.	C	Demo
GUI-130.4	IR-GUI-26, IR-GUI-28	CapTOP shall provide the use of various icon colors on the map display to support subsystem-specific icon states. Refer to subsystem requirements for additional details.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-130.5	IR-GUI-28	CapTOP shall provide the use of flashing icons on the map display to support subsystem-specific icon states. Refer to subsystem requirements for additional details.	C	Demo
GUI-130.6	IR-GUI-31	The CapTOP map display window shall allow users to access an object's data (links, ITS devices) directly from the map display, subject to privilege level. Refer to subsystem requirements for additional details.	C	Demo
GUI-130.6.1	IR-GUI-31	The CapTOP map display window shall allow users to select any object on the map with related data by point-and-click manipulation of a mouse, subject to privilege level.	C	Demo
GUI-130.6.2	IR-GUI-16, IR-GUI-31	CapTOP shall allow the Operator to obtain device ID and device summary status information by hovering over the device icon on the map display. Refer to subsystem requirements for additional details.	1	Demo
GUI-130.6.3	IR-GUI-16, IR-GUI-31	CapTOP shall allow the Operator to obtain detailed device status information by one of the following methods: a. by selecting a status menu item or button from the GUI window launched by left clicking on the device icon on the map display; b. by selecting the status item from the pop-up menu displayed by right clicking on the device icon on the map display. Refer to subsystem requirements for additional details.	C	Demo
GUI-130.6.4	IR-GUI-16, IR-GUI-31	The CapTOP map display shall allow each icon to be clicked to provide the following: a. access to real-time status data; b. access to control functions (if applicable); c. access to icon specific functions. Refer to subsystem requirements for additional details.	1	Demo
GUI-130.6.4.1	IR-GUI-16, IR-GUI-31	CapTOP shall allow the Operator to access configuration/control functions (as applicable) by the following methods: a. by selecting a configuration menu item or button from the GUI window launched by left clicking on the device icon on the map display; b. by selecting the configuration item from the pop-up menu displayed by right clicking on the device icon on the map display. Refer to subsystem requirements for additional details.	1	Demo
GUI-130.6.5	IR-GUI-15	CapTOP shall restrict access to any device control functions if the device is offline.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-130.7	IR-GUI-29, IR-GUI-3	CapTOP shall automatically refresh ITS device status, signal status, incident status, link status, AVL status, and message content for DMS/PDMS/HAR on the map-display in a configurable time interval which is based on the polling rate defined in each subsystem.	C	Demo
GUI-130.8	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon) when confirmed by a user prompt verification.	1	Demo
GUI-140	IR-GUI-2	The geo-referenced map data shall conform to DDOT's GIS standards for seamless information exchange with citywide spatial databases.	1	Demo
GUI-150	IR-GUI-5	The CapTOP map display window shall allow users to display traffic condition data.	C	Demo
GUI-150.1	IR-GUI-42	CapTOP shall be able to display roadway traffic condition information using color-coded traffic network links.	C	Demo
GUI-150.1.1	IR-GUI-42	CapTOP shall be able to be able to display link-based speed, volume, and occupancy conditions.	C	Demo
GUI-150.1.1.1	IR-GUI-42, OR-CMM-4	CapTOP shall be able to display roadway traffic condition information using color-coded traffic network links that display the following when the link speed layer is display: a. Maroon = speed is between 0% and 25% of free flow speed; b. Red = speed is between 25% and 50% of free flow speed; c. Yellow = speed is between 50% and 75% of free flow speed; d. Light Green = speed is between 75% and 90% of free flow speed; e. Dark Green = speed is > 90% of free flow speed.	C	Demo

GUI-150.1.1.2	IR-GUI-42	CapTOP shall be able to display roadway traffic condition information using color-coded traffic network links that display the following when the link volume layer is displayed:
		a. green = low volume;
		b. yellow = medium volume;
		c. red = high volume.
			C	Demo

GUI-150.1.1.3	IR-GUI-42	CapTOP shall be able to display roadway traffic condition information using color-coded traffic network links that display the following when the link occupancy layer is display:
		a. green = low occupancy;
		b. yellow = medium occupancy;
		c. red = high occupancy.
			C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-150.2	IR-GUI-16, OR-DWA-3, OR-DWA-19	CapTOP shall be able to graphically display in the map window the following data on a per link basis based on data fused from all available sensors: a. average speed for current polling interval; b. average volume for the current polling interval; c. average occupancy for the current polling interval.	C	Demo
GUI-150.2.1	IR-GUI-16	When fusing data from multiple sources, CapTOP shall derive a combined metric of the data from all available sources, with the greatest importance given to the data which indicates the poorest traffic performance.	2	Demo
GUI-150.3	IR-GUI-16, IR-GUI-48, IR-GUI-49	CapTOP shall be able to display roadway traffic condition data using data from the following sources: a. speed data from SpeedInfo; b. speed, volume, and occupancy data from Traffic.com; c. speed, volume, and occupancy from DDOT's Traffic Detection Stations; d. speed, volume, occupancy and classification data from DDOT's Permanent Count Stations. e. speed data from Inrix	C	Demo
GUI-150.4	IR-GUI-42, IR-GUI-5, IR-GUI-48, IR-GUI-49	Each traffic condition link on the map display shall be selectable and shall display the following: a. link ID; b. text description of the link; c. road name; d. direction; e. average speed; f. average volume; g. average occupancy.	1	Demo
GUI-150.5	IR-GUI-3	CapTOP shall be able to display roadway traffic condition data based on real-time data.	C	Demo
GUI-150.6	IR-GUI-4	CapTOP shall be able to display roadway traffic condition data based on historical data.	2	Demo
GUI-150.7	OR-TOM-2, SR-SYS-25	CapTOP shall produce a traffic condition report, over a specified time period and a specified area, with a graphical and tabular display that contains the following: a. road name; b. road direction; c. link speeds; d. incident locations; e. link volumes.	1	Demo
GUI-150.8	IR-GUI-25	The network layer shall allow the authorized users to add, delete, and modify roadway links via a toolbar menu.	1	Demo
GUI-160	IR-GUI-54, IR-GUI-55, IR-GUI-61	The CapTOP map display window shall be able to display the location of AVL-equipped vehicles.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-161	IR-GUI-61	CapTOP shall access position reports for vehicles equipped with AVL at a parameter frequency of up to once per 15 seconds and automatically refresh displayed positions of vehicles within 15 seconds of data receipt.	2	Demo
GUI-170	IR-GUI-63	CapTOP shall provide a map-based display to view the following real-time data, updated every 2 minutes, from the INRIX data server for freeway and arterial links in the D.C. region: a. average speed; b. free flow speed; c. travel time data with confidence levels.	1	Demo
GUI-180	IR-GUI-32	CapTOP shall allow the Operator to obtain detailed device status information by using the CapTOP toolbar and searching for the device ID.	C	Demo
GUI-190	IR-GUI-24, IR-GUI-40, IR-GUI-41	CapTOP shall provide a search map feature, where the user enters any of the information to quickly locate a point on the map: a. physical street address; b. latitude/longitude; c. cross streets; d. point of interest name.	1	Demo
GUI-200	IR-GUI-10	CapTOP shall allow the System Administrator to add, edit and delete device icons on the map display window.	C	Demo
GUI-200.1	IR-GUI-10	CapTOP shall prompt the System Administrator with the configuration window to enter all configuration information required to integrate the new device when a device icon is added.	1	Demo
GUI-200.2	IR-GUI-10	CapTOP shall provide a configuration window for the System Administrator to enter, modify, and delete device configuration data.	1	Demo
GUI-200.3	IR-GUI-10	The configuration window shall be available by the System Administrator via pop-up menu on the selected device icon.	1	Demo
GUI-200.4	IR-GUI-10	When a device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with setting the device online or offline.	1	Demo
GUI-210	IR-GUI-10, IR-GUI-27	CapTOP shall allow the System Administrator to create a new device icon on the map display window using following methods: a. by pointing and clicking on a location; b. by entering the physical street address; c. by entering latitude/longitude; d. by entering cross streets; e. by entering a point of interest name.	1	Demo
GUI-220	IR-GUI-27	The CapTOP map display window shall allow the System Administrator to relocate device icons using a drag-and-drop operation.	1	Demo
GUI-230	IR-GUI-30	CapTOP shall automatically refresh PDMS device locations on the map-display whenever their location information is updated in the database within one minute of the availability of new positions data.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-240	OR-DDM-20	CapTOP shall allow the System Administrator to perform the following changes and have the devices used properly within CapTOP without having to perform a system shutdown/restart: a. add, remove and change device icons on the map display; b. add, remove and change ITS device configuration information stored in the central system; c. add, remove, and change ITS device configuration information stored in the device; d. add, remove, and change user accounts.	C	Demo

3.3.4 CapTOP Web Interface Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-250	SR-SYS-29	CapTOP shall provide the ability to support remote users.	C	Demo
GUI-250.1	UR-TO-32	CapTOP shall provide remote users, connecting via the District's existing VPN and using the secure token ID system, the ability to update incident information and control ITS devices, subject to user privileges.	C	Demo
GUI-250.1.1	UR-TO-32	When accessing CapTOP from remote locations, the workstation will be identified as Accessed via VPN for system usage and storage in logs	1	Demo
GUI-250.2	UR-TO-31, SR-SYS-29. OR-CMM-4	CapTOP shall provide remote users, not connected to the DDOT network, the ability to view (view only) the following without username/password authentication: a. incident data; b. traffic condition data; c. ITS device status; d. live video; e. roadway weather information; f. travel time data; g. current DMS messages; h. current HAR messages; i. regional weather information.	C	Demo
GUI-250.3	IR-GUI-7	CapTOP shall allow the display of map-based traffic condition data to the external agencies and the public in real-time via the Internet.	1	Demo
GUI-250.4	IR-GUI-59	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	Demo
GUI-250.5	OR-IM-61, SR-SYS-29	CapTOP shall provide a web interface to display a read-only view of all layers using color coded icons identical to the interface used by TMC Operators.	1	Demo
GUI-250.6	SR-SYS-29	The web interface shall provide a text box to show a summary of ITS device information by clicking on the appropriate device icon.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-250.7	SR-SYS-29	The web interface shall automatically refresh ITS device status according to a time interval set by the System Administrator.	1	Demo
GUI-250.8	SR-SYS-29	The web interface shall show status information only; all configuration and control information shall be disabled.	1	Demo
GUI-260	SR-SYS-32, OR-CMM-5	CapTOP shall provide a web-based interface to view information from the following partners/systems: 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. WASA; k. NAWAS; l. WMATA; m. DPW; n. DC Streetcar Operations; o. DC Tunnel Operations; p. DC Parking Operations.	2, item p priority 3	Demo
GUI-260.1	UR-TO-31, SR-SYS-29	CapTOP shall provide a web-based interface to view the following information from partners in other jurisdictions: a. incident data; b. traffic condition data; c. ITS device status; d. live video; e. roadway weather information; f. regional weather information.	1	Demo

3.3.5 GUI Subsystem Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-270	IR-GUI-15, IR-GUI-51	CapTOP shall provide a status window that displays the list of devices and their operational status for each subsystem, subject to user privileges. Refer to subsystem requirements for additional details.	1	Demo
GUI-270.1	IR-GUI-15, IR-GUI-51	CapTOP shall display device specific status when requested by a user by clicking on a device ID in the subsystem status window, subject to user privileges. Refer to subsystem requirements for additional details.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-280	IR-GUI-15, IR-GUI-51	CapTOP shall provide a report capability for each of the following subsystems or applications, subject to user privileges: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations; d. Traffic.com Stations; e. CCTV; f. HAR; g. DMS/PDMS; h. Traffic Signals; i. RWISs; j. Regional Weather; k. StormTrak; l. Incident Management; m. Map Display/GIS; n. QuicNet 170E Central Software; o. ATC Software Central Software (future); p. Tools: I. Account Management; II. System Configuration; III. Work Order Management (CityWorks); IV. Configuration Management Software; V. System Scheduler; VI. System Events. Refer to subsystem requirements for additional details.	2	Demo
GUI-290	IR-GUI-15, IR-GUI-51	CapTOP shall provide a device configuration capability, for use by the System Administrator, that allows the user to enter, retrieve, display and print configuration information for each of the following subsystems: a. Permanent Count Stations; b. Traffic Detection Stations; c. SpeedInfo Stations (CapTOP to server configuration only; field configuration stored in remote SpeedInfo server); d. Traffic.com Stations (CapTOP to server configuration only; field configuration stored in Traffic.com server); e. CCTV; f. HAR; g. DMS/PDMS; h. Traffic Signals; i. RWISs. Refer to subsystem requirements for additional details.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-300	IR-GUI-15, IR-GUI-51	CapTOP shall provide a control window for each of the following subsystems or applications, subject to user privileges: a. CCTV; b. HAR; c. DMS/PDMS; d. Incident Management; e. Map Display/GIS; f. QuicNet 170E Central Software; g. ATC Software Central Software (future). Refer to subsystem requirements for additional details.	C, item g priority 2	Demo
GUI-310	SR-SYS-15	CapTOP shall provide context-sensitive and online help to support online training for all operator types.	1	Demo
GUI-310.1	UR-TO-10	CapTOP shall provide on-line help for all functions and features.	1	Demo
GUI-310.2	UR-TO-10	CapTOP shall provide the ability to hold the cursor over a GUI feature and obtain context-sensitive help on any GUI window that requires operator input.	1	Demo
GUI-310.3	UR-TO-10	The quality and detail of the help features delivered as part of CapTOP shall be sufficient to guide a user familiar with system operation in the application of the specified feature.	1	Demo
GUI-310.4	UR-TO-10	CapTOP shall be capable of updating help information either from the CapTOP GUI or using office productivity tools (e.g. Microsoft Word) and making the updated information available by a user with System Administrator privilege.	1	Demo

3.3.6 GUI Administrative Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-320	SR-SYS-33	CapTOP shall provide a login window that requires a user to enter a user name and password.	C	Demo
GUI-320.1	SR-SYS-33	The login window shall only allow the user a parameter number of tries (default of 3 tries) to enter a correct user ID and password combination before rejecting the user.	1	Demo
GUI-320.1.1	UR-TO-11	After the parameter number successive failed login attempts, CapTOP shall delay a parameter period of time (default of 30 seconds) before allowing additional attempts.	1	Demo
GUI-320.1.2	UR-TO-11	Following rejection of the user login, attempts to access CapTOP during the period of time before allowing additional attempts shall result in a message on the login screen indicating that the maximum attempts to login has been exceeded.	1	Demo
GUI-320.2	UR-TO-11	CapTOP shall log all successful and failed login attempts (refer to GUI-60.4 for the fields that should be logged).	1	Demo
GUI-320.3	SR-SYS-33	CapTOP shall display an “*” for each character typed as part of the user’s password.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-320.4	SR-SYS-33	CapTOP shall prompt the user to change their password after a configurable amount of time expires since the last password change.	1	Demo
GUI-320.4.1	SR-SYS-33	When a CapTOP password expires, the system shall force the user to change their password, and not permit login until accomplished.	1	Demo
GUI-320.4.2	SR-SYS-33	When a CapTOP password expires the system shall require the user to enter their old password once and their new password twice, each in a separate field.	1	Demo
GUI-320.4.3	SR-SYS-33	If the old password is correct, and new password is a perfect match in the two separate fields, CapTOP shall update the password for that user and permit login; otherwise, an error message will be displayed and the user can retry up to a parameter number of times (default of 3 times) total before a parameter length (default of 30-seconds) timeout occurs.	1	Demo
GUI-320.4.4	SR-SYS-33	The CapTOP password expiration duration shall be configurable from zero (never expires) to 1 year.	1	Demo
GUI-320.4.5	SR-SYS-33	The CapTOP password expiration duration shall default to require a change every 6 months	1	Demo
GUI-320.4.6	SR-SYS-33	CapTOP shall reject attempts to set the new password to the value of the expiring password or the value of a password used by the specific user in a parameter time period (default of 1 year).	1	Demo
GUI-320.4.7	SR-SYS-33	CapTOP shall reject attempts to set passwords to a value less that 8 characters in length and that do not include at least one number and one special character (!@#$%^&*()+-*/<>:;\[]).	1	Demo
GUI-320.4.8	SR-SYS-33	CapTOP shall provide a menu option for a user to replace his password at user initiation.	1	Demo
GUI-330	OR-SMM-5, UR-TO-28	CapTOP shall provide an administration window for System Administrators to manage user accounts.	C	Demo
GUI-330.1	OR-SMM-1	CapTOP shall provide the ability for the System Administrator to create, modify or delete user accounts.	C	Demo
GUI-330.2	OR-SMM-1	Each account shall contain the following attribute information: a. User ID; b. Username; c. E-mail address; d. Telephone number; e. Password; f. Group membership (refer to GUI-340.2.1); g. Privileges (refer to GUI-340.3.1).	C	Demo
GUI-330.2.1	OR-SMM-1	All user passwords shall be stored and displayed in an encrypted fashion.	1	Demo
GUI-330.3	OR-SMM-1	CapTOP shall allow the System Administrator to reset user passwords.	1	Demo
GUI-340	SR-SYS-33	CapTOP shall support multi-levels of privileges to control user access.	C	Demo
GUI-340.1	SR-SYS-34	CapTOP shall provide the capability for the System Administrator to assign privilege levels when a user account is created.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-340.2	OR-SMM-2	CapTOP shall provide the ability for the System Administrator to create, modify or delete groups.	C	Demo
GUI-340.2.1	OR-SMM-3, UR-TO-28	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	Demo
GUI-340.2.2	OR-SMM-4	CapTOP shall allow the System Administrator to add, modify, and delete individuals from the group membership without having to modify individual accounts.	1	Demo
GUI-340.2.3	OR-SMM-6	CapTOP shall allow the System Administrator to override, at the account-level, any privileges assigned at the group-level.	1	Demo
GUI-340.3	OR-SMM-8	CapTOP shall provide access control functions to restrict user access by subsystem.	C	Demo

<table>
<tr><th>FRD Req ID</th><th>ORD Req ID</th><th>Description</th><th>Priority</th><th>Test Method</th></tr>
<tr><td>GUI-340.3.1</td><td>SR-SYS-35,
OR-SMM-5</td><td>CapTOP shall provide the capability for each subsystem and critical function to have user account-level settings for read-only, control (write), and override.
<table>
<tr><th>Subsystem</th><th>Access Right</th></tr>
<tr><td rowspan="6">Incident Management</td><td>1. Access incident status;</td></tr>
<tr><td>2. Transmit alerts and notifications.</td></tr>
<tr><td>3. Enable or disable the ability to classify incidents;</td></tr>
<tr><td>4. Access account management functions;</td></tr>
<tr><td>5. Execute incident response plans;</td></tr>
<tr><td>6. Enable or disable the ability to generate reports;</td></tr>
<tr><td rowspan="4">System Administration</td><td>7. Access archive data;</td></tr>
<tr><td>8. Access system administration functions in the system;</td></tr>
<tr><td>9. Update configuration information for the system;</td></tr>
<tr><td>10. Update configuration information for all ITS devices;</td></tr>
<tr><td rowspan="9">HAR</td><td>11. Access HAR events and alarm logs;</td></tr>
<tr><td>12. Listen to current HAR recording;</td></tr>
<tr><td>13. Transmit a HAR recording;</td></tr>
<tr><td>14. Create a HAR recording;</td></tr>
<tr><td>15. Turn HAR transmitters on/off;</td></tr>
<tr><td>16. Edit HAR message schedule;</td></tr>
<tr><td>17. Access HAR status;</td></tr>
<tr><td>18. Override control of a locked HAR;</td></tr>
<tr><td>19. Access HAR maintenance/diagnostic status;</td></tr>
<tr><td rowspan="7">DMS</td><td>20. Access DMS/PDMS events and alarm logs;</td></tr>
<tr><td>21. Transmit DMS/PDMS message;</td></tr>
<tr><td>22. Create DMS/PDMS message;</td></tr>
<tr><td>23. Edit DMS/PDMS message schedule;</td></tr>
<tr><td>24. Override control of a locked DMS/PDMS;</td></tr>
<tr><td>25. Access DMS/PDMS status;</td></tr>
<tr><td>26. Access DMS/PDMS maintenance/diagnostic commands;</td></tr>
<tr><td rowspan="7">CCTV</td><td>27. Access CCTV events and alarms;</td></tr>
<tr><td>28. Access live and recorded video;</td></tr>
<tr><td>29. Camera controls;</td></tr>
<tr><td>30. Edit CCTV tour schedule;</td></tr>
<tr><td>31. Override control of a locked camera;</td></tr>
<tr><td>32. Camera status;</td></tr>
<tr><td>33. CCTV maintenance/diagnostic interface;</td></tr>
<tr><td rowspan="2">Traffic Signals</td><td>34. Access traffic signal events and alarms;</td></tr>
<tr><td>35. Access traffic signal status;</td></tr>
<tr><td rowspan="3">Traffic Detection Stations</td><td>36. Access traffic detection station events and alarms;</td></tr>
<tr><td>37. Access traffic detection station status;</td></tr>
<tr><td>38. Access traffic detection station data;</td></tr>
<tr><td rowspan="3">Permanent Count Stations</td><td>39. Access permanent count station events and alarms;</td></tr>
<tr><td>40. Access permanent count station status;</td></tr>
<tr><td>41. Access permanent count station data;</td></tr>
<tr><td rowspan="3">SpeedInfo Stations</td><td>42. Access SpeedInfo station events and alarms;</td></tr>
<tr><td>43. Access SpeedInfo station status;</td></tr>
<tr><td>44. Access SpeedInfo station data;</td></tr>
<tr><td rowspan="3">Traffic.com Stations</td><td>45. Access Traffic.com station events and alarms;</td></tr>
<tr><td>46. Access Traffic.com station status;</td></tr>
<tr><td>47. Access Traffic.com station data;</td></tr>
<tr><td rowspan="2">Road Weather Information Status</td><td>48. Access RWIS events and alarms;</td></tr>
<tr><td>49. Access RWIS status;</td></tr>
</table></td><td>C</td><td>Demo</td></tr>
<tr><td>GUI-340.3.2</td><td>OR-SMM-5</td><td>CapTOP shall support role-based access by allowing each group to be configured with default settings of each privilege (refer to GUI-340.3.1 for each privilege).</td><td>C</td><td>Demo</td></tr>
<tr><td>GUI-350</td><td>OR-DOC-22,
OR-DOC-30</td><td>CapTOP shall be able to define and schedule planned incidents and subsystem device commands for execution using a schedule editor.
Refer to subsystem requirements for additional details.</td><td>C</td><td>Demo</td></tr>
</table>

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-350.1	OR-DOC-22, OR-DOC-30	The CapTOP schedule capability shall permit time of day recurring and non-recurring entries for schedule entries.	1	Demo
GUI-350.2	OR-DOC-5, OR-DOC-12, OR-DOC-13, OR-DOC-22, OR-DOC-27	CapTOP shall be able to schedule the following: a. DMS/PDMS messages; b. HAR messages; c. CCTV tours; d. Notifications and alerts; e. Special events; f. Road closures; g. Maintenance activities.	C	Demo
GUI-350.3	OR-DOC-22, OR-DOC-30	The schedule shall permit non-recurring, one-time only schedule entries, where the user specifies a schedule name, event name or device ID, message ID (if applicable), reminder date/time, start date/time and end date/time.	C	Demo
GUI-350.4	OR-DOC-22, OR-DOC-30	CapTOP shall provide a recurring schedule capability and permit any of the following recurring entry types: a. Weekdays – Monday through Friday; b. Weekends – Saturday and Sunday only; c. All Days – Monday through Sunday; d. One day or any combination of days per week; e. One day or any combination of days per month	C	Demo
GUI-350.4.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow recurring schedule entries to be created for schedule entries, where the user specifies a schedule name, event name or device ID, recurring entry type, message ID (if applicable), reminder date/time, start date/time and end date/time (optional).	1	Demo
GUI-350.4.2	OR-DOC-22, OR-DOC-30	CapTOP shall permit an optional end date to be specified for all recurring schedule entries.	1	Demo
GUI-350.4.2.1	OR-DOC-22, OR-DOC-30	CapTOP shall implement the recurring scheduling indefinitely if no end date is specified.	1	Demo
GUI-350.4.3	OR-DOC-22, OR-DOC-30	CapTOP shall allow a Holiday schedule to be specified for the CapTOP system.	1	Demo
GUI-350.4.3.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to indicate whether each Holiday is treated as an exception to the recurring schedule.	1	Demo
GUI-350.4.3.2	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to specify each Holiday exception to be treated as either a Weekend or Weekday whenever encountered.	1	Demo
GUI-350.4.4	OR-DOC-22, OR-DOC-30	CapTOP shall allow recurring schedule entries that traverse a day boundary (e.g. overnight DMS message display) to be managed as a single schedule entry.	1	Demo
GUI-350.5	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to edit and delete scheduled entries based on user privilege.	1	Demo
GUI-350.6	OR-DOC-5, OR-DOC-12, OR-DOC-13, OR-DOC-22, OR-DOC-27	The schedule capability shall allow activities to be scheduled up to 5 years in the future.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
GUI-350.7	OR-DOC-22, OR-DOC-30	CapTOP shall provide a pop-up reminder to operators logged into the system prior to the start of each scheduled activity.	1	Demo
GUI-350.7.1	OR-DOC-22, OR-DOC-30	The reminder time shall be configurable based on each schedule entry.	1	Demo
GUI-350.8	IR-GUI-10	CapTOP shall provide the ability to create, view, edit, and delete an area expected to be affected by special events and roadway closures defined by a closed polygon.	1	Demo
GUI-360	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; e. generate operator performance reports (refer to IM-360*).	1	Demo
GUI-370	SR-SYS-2	CapTOP shall provide a graphical user interface that allows the user to display the following: a. a list of all required CapTOP client processes (custom and COTS processes); b. a list of all required CapTOP server processes (custom and COTS processes).	2	Demo
GUI-370.1	SR-SYS-2	The display shall update in real-time to reflect the current status of each process.	2	Demo
GUI-370.2	SR-SYS-2	For each process, the display shall include the following: a. process name; b. machine where executing; c. status (running, stopped, failed); d. uptime; e. colored process status icon as follows: I. green = normal; II. yellow = stalled or failed; III. red = stopped.	2	Demo
GUI-370.3	SR-SYS-2	The System Administrator or TMC Manager shall have controls to be able to stop/start/restart each process.	2	Demo
GUI-380	SR-SYS-2	CapTOP shall automatically start all required processes on client workstations and servers on boot-up.	1	Demo
GUI-390	OR-IM-70	CapTOP shall provide an interface allowing for a single entry and verification of AMBER Alert messages for a user of sufficient privilege, providing for the immediate creation, editing, verification, and display of the message on each sign type requested.	1	Demo
GUI-390.1	OR-IM-70	CapTOP shall prompt for revision of AMBER Alert messages for each sign type if an AMBER Alert message is determined by the system to not properly display on that sign type.	1	Demo
GUI-390.2	OR-IM-70	CapTOP shall allow manual revision of AMBER Alert messages for specific signs or sign types by a user with sufficient privilege.	1	Demo

3.4 Process Requirements

3.4.1 Process Initialization and Termination

Refer to GUI-370* and GUI-380 for process initialization and termination requirements.

3.4.2 Process Status and Monitoring

Refer to GUI-370* for process status and monitoring requirements.

3.5 Configuration Requirements

3.5.1 Parameter Selection and Table Updates

Configuration parameters dealing with the CapTOP system are addressed in the section **Error! Reference source not found.** of the Database Requirements section. Configuration requirements are also addressed in each subsystem. Refer to XXX-30.2*, where XXX is the functional area abbreviation (e.g., CCT=CCTV, SIG=Traffic Signals, etc. A full list of abbreviations can be found in TABLE 1).

3.5.2 Configuration Management Software

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CMS-10	SR-SYS-6, SR-SYS-26, UR-TO-28	CapTOP or related third party software shall provide capabilities of a COTS-based configuration management system.	1	Demo
CMS-10.1	SR-SYS-6, SR-SYS-26, UR-TO-28	The CM system shall provide version control with version numbers and descriptions to identify changes to the following configuration controlled items: a. CapTOP source code; b. CapTOP COTS products; c. CapTOP user manuals; d. CapTOP maintenance manuals; e. CapTOP configuration files.	1	Demo
CMS-10.2	SR-SYS-6, SR-SYS-26, UR-TO-28	The CM system shall provide reports to indicate the following: a. Files currently checked out; b. File change history; c. A list of all files, their current version, and when last checked in.	1	Demo

3.6 Support Function Requirements

3.6.1 Event Handling, Including Error Logging, Visual/Audible Alarms

CapTOP's event handling, event displays, error logging, and visual/audible alarms are included in the GUI section. Refer to the GUI-60* requirements for more information.

3.6.2 Communication Text Messaging / Alerts

CapTOP's text messaging and alert requirements are included in the Incident Management section. Refer to the INM-100* and INM-180* requirements for more information.

3.6.3 Task and Event Scheduler

CapTOP's task and event scheduler requirements are included in the GUI section. Refer to the GUI-350* requirements, and also the scheduler requirements within each subsystem, as applicable.

3.6.4 System Backups

CapTOP's system backup requirements are included in the System-Level requirements section. Refer to the SYS-240* and SYS-250* requirements for more information.

Also, refer to the database backup requirements. Refer to section **Error! Reference source not found.** for additional information.

3.6.5 Performance Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PER-10	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	Demo
PER-20	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	Demo
PER-30	PR-SYS-3	CapTOP shall be able to recover from workstation failures by allowing a user to access a backup workstation and resume the session previously active on the failed workstation.	2	Demo
PER-40	PR-SYS-4	CapTOP shall be able to effectively recover 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 without action taken by TMC or other DDOT staff.	2	Demo
PER-50	PR-SYS-5	CapTOP shall provide the ability to allow all communication devices to be failed over to redundant servers without action taken by TMC or other DDOT staff.	2	Demo
PER-60	PR-SYS-6	CapTOP shall be able to recover from a catastrophic failure using a backup of all CapTOP application, database, and communication server software and databases with data loss limited to the period from the failure to the system restoration.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PER-70	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.	C	Demo/ Analyze
PER-80	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	Demo

3.6.6 System Failover

CapTOP's failover requirements are included in the Performance Requirements section. Refer to the PER-30 through PER-80 requirements for more information. Also refer to Database Backup and Failure Requirements (DBF-*) in section **Error! Reference source not found.**.

Also refer to Section **Error! Reference source not found.** below.

3.6.7 Backup TMC

CapTOP's requirements for the Backup TMC are included in the System-Level requirements section. Refer to the SYS-260* requirements for more information.

3.6.8 On-Line Help

CapTOP's on-line help requirements are included in the GUI section. Refer to the GUI-310* requirements for additional information.

3.6.9 On-Line Documentation

CapTOP's on-line help requirements are included in the System-Level requirements section. Refer to the SYS-230 requirement for additional information.

3.6.10 Traffic Data Analysis and Visualization

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDA-10	PR-SYS-1	CapTOP shall provide an interface to a future Traffic Data Server to obtain traffic condition data and to view graphical displays.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDA-10.1	PR-SYS-1	CapTOP shall interface with the future Traffic Data Server to obtain data from these sources: a. permanent count stations; b. traffic detection stations; c. SpeedInfo stations; d. Traffic.com stations; e. INRIX sensors; f. WIM stations. Refer to TDS-70*, PCS-70*, TDC-70*, SPD-70*, RTC-40*, and CVN-140*.	1, item f priority 2	Demo
TDA-10.2	PR-SYS-1	CapTOP shall interface with the future Traffic Data Server to view graphical visualization displays of traffic data.	1	Demo

3.6.11 Performance Measurement Requirements

CapTOP's performance measurement requirements are addressed in various sections. Refer to the following requirements:

- SYS-170;
- DBR-30*;
- DBR-40*;
- DBR-50;
- DBR-60;
- IM-360*;
- CCT-410;
- TDS-120;
- PCS-130;
- TDC-120;
- SPD-120;
- DMS-260;
- HAR-250;
- SIG-180;
- RWI-120.

3.6.12 System Administration Functions

There are many System Administration functions in CapTOP. Following is a summary of the key requirements:

- **Account Management:** CapTOP's system administration requirements are included in the GUI requirements section. Refer to the GUI-330* and GUI-340* requirements for more information.

- **Configuration Management:** CapTOP's configuration management requirements are included in the Database and GUI requirements section. Refer to the CDB-* and GUI-200* requirements for more information.

- **Process Management:** Refer to GUI-370* and GUI-380 for process initialization and termination requirements.

Note: additional System Administration requirements can be found in this document by performing a "find" and searching for "System Administrator".

3.7 Subsystem Functional Requirements

3.7.1 Traffic Surveillance Requirements

This section describes the functional requirements needed to perform traffic surveillance.

3.7.1.1 CCTV Requirements

3.7.1.1.1 Accessing the CCTV System

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-10	OR-DOC-1, OR-DOC-10, OR-CMM-4	CapTOP shall allow the TMC Operator to access the CCTV subsystem, subject to operator privilege level.	C	Demo
CCT-10.1	OR-DOC-10	CapTOP shall allow the TMC Operator to access the CCTV subsystem, using the following mechanisms: a. Left clicking on a CCTV camera icon on the map display; b. Left clicking on the CCTV subsystem icon off the CapTOP toolbar; c. Left clicking on the CCTV subsystem menu off the CapTOP toolbar.	1	Demo
CCT-10.2	OR-SMM-5, OR-DOC-11	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. CCTV events and alarms; b. Live and recorded video; c. Camera controls (refer to CCT-130); d. Editing of CCTV tour schedule; e. Camera status (refer to CCT-40); f. Override control if a camera is locked; g. CCTV maintenance/diagnostic interface.	C	Demo
CCT-20	IR-GUI-10	CapTOP shall display all camera icons on a separate layer on the map-based display.	1	Demo
CCT-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the CCTV layer on the map display.	1	Demo
CCT-20.2	IR-GUI-11	CapTOP shall allow the TMC Operator to left click a camera icon and perform the following with no more than 2 additional clicks: a. View the video locally on the desktop; b. Invoke the camera control window (refer to	1	Demo

		CCT-130); c. Route video to a video wall monitor; d. Invoke the camera status window (refer to CCT-50); e. Invoke the camera routing window.		
CCT-20.3	IR-GUI-12	The icons used for the CCTV icon layer shall be unique from icons used in other layers.	1	Demo
CCT-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify CCTV devices from the CapTOP map display (also refer to GUI-200*).	C	Demo
CCT-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new CCTV icon using a pop-up menu.	1	Demo
CCT-30.2	IR-GUI-10	When a CCTV device icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	1	Demo
CCT-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each CCTV device to enable the device to become operational in the system, with basic information required during entry into the system: a. Controller ID (Basic); b. Description; c. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Closest Intersection/Interchange. d. Online-Offline Mode (Basic) (static – set by System Administrator or Maintenance Technician); e. Encoding Type (Basic) (MPEG-2, MPEG-4, H.264); f. Communication Type (Basic) (IP, Encoded, Video Switcher); g. Video Switcher Input No. (Basic, if applicable); h. Multidrop Information (Basic, if applicable); I. Drop Address (Basic, if applicable); II. Channel ID (Basic, if applicable); III. Port Name (Basic, if applicable). i. IP Information (Basic, if applicable); I. IP Address (Basic, if applicable); II. Port Number (Basic, if applicable). j. Serial Information (Basic, if applicable); I. Baud Rate (Basic, if applicable); II. No. Data Bits (Basic, if applicable);	1	Demo

		III. Parity (Basic, if applicable); IV. No. Stop Bits (Basic, if applicable); V. H/W Flow Control (Basic, if applicable); VI. S/W Flow Control. (Basic, if applicable) k. NTCIP Community (Basic); l. Firmware Version; m. Cabinet Number; n. Controller Model Number; o. Protocol (Basic); p. Link ID; q. Polling Enabled (yes/no, defaults to yes); r. Comm Loss Timeout (seconds in .1 increments); s. Associated HAR; t. Associated DMS; u. Control Mode (central, local, central override); v. TMDD Information; I. Horizontal Datum (Basic) (WGS84, 84EGM96, NAD83); II. Latitude (Basic) (decimal degrees); III. Longitude (Basic) (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
CCT-30.2.2	IR-GUI-10	When a CCTV device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with setting the device online or offline.	1	Demo
CCT-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo
CCT-30.3	IR-GUI-10, IR-GUI-11	CapTOP shall allow a CCTV device icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. allowing the device icon to be deleted.	1	Demo
CCT-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name;	1, item l priority 2	Demo

		c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Online-Offline Mode (online/offline); h. Communication Type (dialup serial, network serial, IP); i. Protocol; j. Link ID; k. Polling Enabled (yes/no, defaults to yes); l. Associated HAR; m. Associated DMS; n. Control Mode (central, local, central override); o. Encoding Type (MPEG-2, MPEG-4, H.264); p. Communication Type (IP, Encoded, Video Switcher).		
CCT-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
CCT-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
CCT-30.4.3	OR-IM-4	CapTOP shall allow the user to select "Other" and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.1.1.2 Monitoring Camera Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-40	OR-DOC-10, IR-GUI-16	CapTOP shall allow the TMC Operator to retrieve and display the following operational status of any camera, subject to operator privilege level: a. Controller ID; b. Online-offline mode (static – set by System Administrator or Maintenance Technician); c. Communication status (OK, failed); d. Controller status (OK, failed); e. Control mode (central, local, central override); f. Lock status (username if locked); g. Display blocked to public (yes/no); h. Where displayed; i. Auto-iris status; j. Auto-focus status; k. Current title; l. Last contact (date/time); m. Last communication status change (date/time); n. Alarm status.	C	Demo
CCT-40.1	OR-DOC-1	CapTOP shall use data from the following sources to	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		determine operational status: a. data reported from the cameras; b. data gained by CapTOP in attempts to communicate with the cameras; c. online/offline information entered manually by authorized CapTOP users.		
CCT-50	SR-SYS-2, IR-GUI-29, IR-GUI-36, IR-GUI-26	CapTOP shall allow users to simultaneously view camera status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display; b. Via the camera status window which lists all cameras, the Controller ID, location, online-offline mode, and controller status.	C	Demo

CCT-50.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following colors for device icon states:
		a. Green = online;
		b. Red = device failure;
		c. Yellow = communication failure;
		d. Gray = offline;
		e. Operator lock = black;
		f. Partial operation or recent failure = brown.
			C	Demo

CCT-50.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: a. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; b. In order for the device icon to be green, the device must be both online and have OK communication.	C	Demo
CCT-50.2	IR-GUI-29	The refresh rate for the status of the icons and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
CCT-50.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to CCT-40 for the list of fields) by hovering over a CCTV camera icon.	1	Demo
CCT-50.4	IR-GUI-29	CapTOP shall allow the user to select on any camera in the camera status window (refer to CCT-50 item b) and view all details (full status, configuration information, and camera controls) pertaining to that camera.	1	Demo
CCT-60	SR-SYS-2, IR-GUI-29, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a CCTV camera by the following methods: a. by device ID; b. IP address of encoder; c. IP address/drop address/channel ID of camera; d. by street name; e. by geographical address; f. by intersection/interchange.	C	Demo
CCT-60.1	SR-SYS-2, IR-GUI-29	CapTOP shall allow the TMC Operator to search for CCTV cameras using a rubber-band style box on the map display to search an area.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-60.2	SR-SYS-2, IR-GUI-29	The result of each search shall be a list of CCTV cameras that are sorted, by default, by device ID.	1	Demo
CCT-60.3	SR-SYS-2, IR-GUI-29	The result of each search shall be a list of cameras sortable by camera ID, IP address/drop address/channel ID, street name, geographical address, and intersection/interchange.	1	Demo
CCT-70	IR-GUI-13	CapTOP shall provide a monitoring and control interface through communication servers for managing the CCTV cameras.	C	Demo
CCT-70.1	OR-DOC-11, SR-SYS-8, SR-SYS-23	CapTOP shall provide a monitor and control interface to all cameras using the latest CCTV NTCIP 1205/1212 standards, if supported by the camera; otherwise, CapTOP shall conform to the existing camera's supported protocol.	C	Demo
CCT-70.1.1	OR-DOC-11, SR-SYS-8, SR-SYS-23	For CCTV that do not support the NTCIP protocol, CapTOP shall implement the native Phillips-Bosch protocol for KD6 model cameras.	C	Demo
CCT-70.2	IR-GUI-13	CapTOP shall be able to request camera status and obtain status response data through the monitoring and control interface.	1	Demo
CCT-70.2.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
CCT-70.3	IR-GUI-13	CapTOP shall be able to issue control commands and receive status response through the monitoring and control interface.	C	Demo
CCT-70.4	IR-GUI-17	CapTOP shall be capable of communicating to CCTV devices using the following physical communication media: a. network connections.	C	Demo
CCT-80	UR-TO-25	CapTOP shall provide the Maintenance Technician the ability to monitor the performance and the status of the following: a. TMC video equipment; b. Snow Management Center video equipment; c. CCTV encoders/decoders; d. CCTV cameras communication status (OK, failed); e. CCTV cameras control mode (central, local, central override); f. CCTV video.	1	Demo
CCT-90	OR-C2F-2, OR-DWA-13	CapTOP shall be able to store camera operational status (refer to CCT-40) in the CapTOP operations database.	1	Demo
CCT-90.1	OR-C2F-2, OR-DWA-13	CapTOP shall be able to store camera equipment status on state transitions.	1	Demo
CCT-100	OR-TDCA-20	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and display all configuration data available from the CCTV camera field controller/receiver, including the following: a. Presets; b. Auto-home settings;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		c. Focus settings; d. Iris settings; e. Pan/tilt/zoom speeds; f. Titles; g. Alarm configurations; h. Sector configurations; i. Video logos; a. Compass settings.		
CCT-110	OR-TDCA-21	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and store all camera field controller/receiver configuration data in the CapTOP central system device configuration database for CCTV cameras.	1	Demo
CCT-120	OR-TDCA-22	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, download all camera configuration data from the CapTOP central system device configuration database to the CCTV camera field controller/receiver.	1	Demo

3.7.1.1.3 CCTV Control Commands

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-130	OR-DOC-11, SR-SYS-23	CapTOP shall allow the TMC Operator to issue the following commands to any camera, using a GUI control window, subject to operator privilege level: a. Pan left; b. Pan right; c. Tilt up; d. Tilt down; e. Pan/tilt diagonally upper right; f. Pan/tilt diagonally lower right; g. Pan/tilt diagonally upper left; h. Pan/tilt diagonally lower left; i. Zoom in; j. Zoom out; k. Open iris; l. Close iris; m. Enable auto iris; n. Disable auto iris; o. Focus near; p. Focus far; q. Enable auto focus; r. Disable auto focus; s. Increase pan speed; t. Decrease pan speed; u. Increase tilt speed; v. Decrease tilt speed; w. Go to preset; x. Delete preset; y. Enable auxiliary function; z. Disable auxiliary function; aa. Power reset.	C, items m – aa priority 1	Demo
CCT-130.1	OR-DOC-11, SR-SYS-8, SR-SYS-23	CapTOP shall notify the TMC Operator of any failed command transmissions.	1	Demo
CCT-130.2	OR-DOC-11 SR-SYS-14	CapTOP shall access camera control functions via an intuitive, Windows-based GUI.	C	Inspect
CCT-140	OR-DOC-11, SR-SYS-23	CapTOP shall support a programmable macro capability similar to Microsoft Word or Excel macros.	3	Demo
CCT-140.1	OR-DOC-11, SR-SYS-23	The TMC Operator shall be able to configure a minimum of 100 macros in the system.	3	Demo
CCT-140.2	OR-DOC-11, SR-SYS-23	A macro shall be able to be triggered from any (all are required, none are optional) of the following stimuli: a. RS-232C input via any COM port; b. TCP/IP input; c. At user login; d. At the occurrence of a regular scheduled event (e.g., date and time), which is non-recurring; e. At the occurrence of a recurring scheduled event (e.g., every Monday at 6:30 AM);	3	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-140.3	OR-DOC-11, SR-SYS-23	Each programmable macro shall allow the TMC Operator to perform any of the following: a. View a camera at its current position; b. View a camera at a defined preset; c. View a video tour; d. View the message on a DMS/PDMS; e. Activate the incident management system; f. Run an external application; g. Alert the TMC Operator using a pop-up; h. Alert the TMC Operator using an audible; i. Activate a dry-contact; j. Load a map file.	3	Demo
CCT-140.4	OR-DOC-11, SR-SYS-23	The TMC Operator shall be able to configure the order of executed steps that comprise a macro, through an intuitive CapTOP GUI.	3	Demo
CCT-140.5	OR-DOC-11, SR-SYS-23	CapTOP shall have the ability to enable/disable macros.	3	Demo
CCT-150	SR-SYS-2, IR-GUI-19	CapTOP shall allow two or more different users to simultaneously control two or more different cameras at the same time.	1	Demo
CCT-150.1	SR-SYS-2, IR-GUI-29	CapTOP shall take no longer than 20 seconds after command transmission to update the status of the CCTV camera within the system.	1	Demo
CCT-160	SR-SYS-2, SR-SYS-12	CapTOP shall allow users, with proper privileges, to monitor and control any camera, from any CapTOP workstation.	1	Demo
CCT-170	SR-SYS-2, OR-SMM-5	CapTOP shall provide a software locking mechanism to prevent 2 or more operators from simultaneously controlling the same camera.	C	Demo
CCT-170.1	SR-SYS-2, OR-SMM-5	CapTOP shall allow all TMC operators, subject to privilege level, to only view the camera status and video (not control), if the camera is locked.	C	Demo
CCT-170.2	SR-SYS-2, OR-SMM-5	CapTOP shall provide a notification to the user when he attempts to control a camera currently locked by another user.	1	Demo
CCT-170.2.1	SR-SYS-2, OR-SMM-5	The notification shall provide the ID of the camera and the user name that has the camera locked.	1	Demo
CCT-170.3	OR-SMM-5	CapTOP shall allow a camera icon to be left clicked on the map display by the TMC Operator, subject to privilege level, and enable locking with no more than 2 clicks.	1	Demo
CCT-170.4	OR-SMM-5	CapTOP shall remove camera locks set by an individual user when that user logs out of the system.	1	Demo
CCT-170.5	OR-SMM-5	CapTOP shall remove camera locks after a configurable time period has elapsed.	1	Demo
CCT-180	SR-SYS-2, OR-SMM-5	CapTOP shall provide the ability for a user with override privileges to unlock cameras that are locked.	1	Demo
CCT-180.1	OR-SMM-5	CapTOP shall issue an alert to a user when a camera that the user locked has been overridden.	1	Demo

3.7.1.1.4 CCTV Tours

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-190	OR-DOC-13, IR-GUI-34	CapTOP shall allow tours to be created by the TMC Operator, subject to privilege level.	1	Demo
CCT-190.1	OR-DOC-13, IR-GUI-34	CapTOP shall allow users to define camera "tours" that present views of multiple cameras.	1	Demo
CCT-190.2	OR-DOC-13, IR-GUI-34	CapTOP shall allow tours to consist of the following: a. Unique Tour Name b. Ordered list of: 1. Camera ID; 2. Preset Number (optional); 3. Dwell Time. c. A flag that indicates if the tour executes endlessly or not.	1	Demo
CCT-190.3	IR-GUI-34 OR-DOC-13	CapTOP shall allow storage of at least 50 independent camera tours and execution of at least 10 independent camera tours simultaneously.	1	Demo
CCT-200	OR-DOC-13	CapTOP shall allow the TMC Operator to view a list of the defined tours through the CapTOP GUI.	1	Demo
CCT-210	OR-DOC-13, IR-GUI-34	CapTOP shall allow the TMC operator to delete tours, subject to privilege level.	1	Demo
CCT-220	OR-DOC-13, IR-GUI-34	CapTOP shall allow the TMC operator to modify tours, subject to privilege level..	1	Demo
CCT-220.1	OR-DOC-13, IR-GUI-34	CapTOP shall allow the TMC operator to change any of the following: a. Unique Tour Name (if changed will rename tour); b. Ordered list of: 1. Camera ID; 2. Preset Number (optional); 3. Dwell Time. c. The flag that indicates if the tour executes endlessly or not.	1	Demo
CCT-220.2	OR-DOC-13, IR-GUI-34	CapTOP shall allow the TMC operator to reorder the sequence of cameras/presets in the tour.	1	Demo
CCT-220.3	OR-DOC-13, IR-GUI-34	CapTOP shall allow the TMC operator to add additional cameras and presets to an existing tour.	1	Demo
CCT-220.4	OR-DOC-13, IR-GUI-34	CapTOP shall allow the TMC operator to remove cameras and presets from an existing tour.	1	Demo
CCT-230	OR-DOC-13, IR-GUI-34	CapTOP shall allow the TMC Operator to execute a tour and view the video on any of the following: a. NTSC video monitor; b. VGA/XVGA computer monitor; c. wall display.	1	Demo
CCT-240	OR-DOC-13	CapTOP shall allow tours to be executed manually by the TMC Operator.	1	Demo
CCT-240.1	OR-DOC-13	When a tour is executed that requests display and preset execution of a locked camera, CapTOP shall display the camera as requested, but not execute the preset, nor enter an attempt to control a locked camera into any log.	1	Demo

3.7.1.1.5 CCTV Tour Schedule

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-250	OR-DOC-22, OR-DOC-30	CapTOP shall be able to define and schedule camera tours to be executed automatically according to a schedule using a schedule editor.	1	Demo
CCT-250.1	OR-DOC-14	CapTOP shall be able to define and schedule camera tours to be executed to monitor the following traffic operations: a. Morning rush hour; b. Afternoon rush hour; c. Special events; d. Any other time desired.	1	Demo
CCT-250.2	OR-DOC-22, OR-DOC-30	The CapTOP schedule capability shall permit time of day recurring and non-recurring entries for camera tours.	1	Demo
CCT-250.3	OR-DOC-22, OR-DOC-30	The schedule shall permit a non-recurring, one-time only camera tour to be executed, where the user specifies a schedule name, camera tour name, reminder date/time, start date/time and end date/time.	1	Demo
CCT-250.4	OR-DOC-22, OR-DOC-30	CapTOP shall provide a recurring schedule capability and permit any of the following recurring entry types: a. Weekdays – Monday through Friday; b. Weekends – Saturday and Sunday only; c. All Days – Monday through Sunday; d. One day or any combination of days per week; e. One day or any combination of days per month.	1	Demo
CCT-250.4.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow recurring schedule entries to be created for a camera tour, where the user specifies a schedule name, camera tour name, recurring entry type, reminder date/time, start date/time and end date/time (optional).	1	Demo
CCT-250.4.2	OR-DOC-22, OR-DOC-30	CapTOP shall permit an optional end date to be specified for all recurring schedule entries.	1	Demo
CCT-250.4.2.1	OR-DOC-22, OR-DOC-30	CapTOP shall implement the recurring scheduling indefinitely if no end date is specified.	1	Demo
CCT-250.4.3	OR-DOC-22, OR-DOC-30	CapTOP shall allow a Holiday schedule to be specified for the CapTOP system.	1	Demo
CCT-250.4.3.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to indicate whether each Holiday is treated as an exception to the recurring schedule.	1	Demo
CCT-250.4.3.2	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to specify each Holiday exception to be treated as either a Weekend or Weekday whenever encountered.	1	Demo
CCT-260	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to edit and delete scheduled entries for camera tours.	1	Demo

3.7.1.1.6 CCTV Presets

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-270	OR-DOC-12	CapTOP shall allow presets to be created by the TMC Operator, subject to privilege level.	C	Demo
CCT-270.1	OR-DOC-12	CapTOP shall be able to exchange preset data between	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		CapTOP storage and CCTV controller storage, identifying discrepancies and allowing users to select which preset data to retain, and making the preset data sets consistent.		
CCT-280	OR-DOC-12	CapTOP shall allow users to define a minimum of 8 camera presets per camera.	1	Demo
CCTV290	OR-DOC-12	CapTOP shall allow each preset to be uniquely named and to store the camera pan, tilt, zoom, focus and iris settings with each preset.	C	Demo
CCT-300	OR-DOC-12	CapTOP shall allow the TMC operator to delete presets.	C	Demo
CCT-310	OR-DOC-12	CapTOP shall allow the TMC operator to rename presets.	C	Demo
CCT-320	OR-DOC-12	CapTOP shall allow the TMC Operator view the presets defined for any camera.	C	Demo
CCT-330	OR-DOC-12	CapTOP shall allow the TMC Operator to go to any preset defined for any camera.	C	Demo
CCT-330.1	OR-DOC-12	CapTOP shall ensure that presets are accurately recalled and provide the resolution to allow return to predefined positions within 1-degree of the stored pan/tilt position.	1	Test
CCT-330.2	OR-DOC-12	CapTOP shall display the title of an activated preset within the video image, at user option.	2	Demo

3.7.1.1.7 CCTV Video Routing

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-340	OR-DOC-11	CapTOP shall allow video routing commands to be executed by the TMC Operator, subject to privilege level.	C	Demo
CCT-340.1	OR-DOC-11	CapTOP shall allow video routing commands to be executed by having the CCTV server communicate with the existing video switcher.	C	Demo
CCT-340.1.1	OR-DOC-11	CapTOP shall provide a video routing interface to DDOT's existing Bosch Allegiant video switcher using the existing video switcher's native protocol.	C	Demo
CCT-340.2	OR-DOC-11	CapTOP shall allow video routing commands to be executed by having the CCTV server communicate with the future hardware MPEG-2/MPEG-4/H.264 decoders to change the multicast IP address listened to by the decoder.	1	Demo
CCT-350	OR-DOC-11, SR-SYS-23	CapTOP shall allow the TMC operator to be able to route any video input to any video output, except another operator's workstation.	C	Demo
CCT-350.1	OR-DOC-11, SR-SYS-23	CapTOP shall provide a list of all the video inputs.	C	Demo
CCT-350.2	OR-DOC-11, SR-SYS-23	CapTOP shall provide a graphical representation, using selectable icons, embedded selectable graphics or other methods to graphically depict the video wall, and all other available outputs cabinet of receiving video.	C	Demo
CCT-350.3	OR-DOC-10,	CapTOP shall provide a drag-and-drop capability to	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	SR-SYS-23	route any video input to any video output.		
CCT-350.4	OR-DOC-11, SR-SYS-23	CapTOP shall support the following video inputs: a. NTSC cameras; b. IP cameras encoded as MPEG-2, MPEG-4 or H.264; c. DVRs; d. VCRs; e. Camera tours.	C	Demo
CCT-350.5	OR-DOC-11, SR-SYS-23	CapTOP shall support the following video outputs: a. NTSC monitors; b. VGA/XVGA monitors; c. DVRs; d. VCRs.	C	Demo
CCT-350.6	OR-DOC-11, OR-IM-13	CapTOP shall allow the TMC Operator to click on a camera icon off the map display and view video on any NTSC monitor.	C	Demo
CCT-350.7	OR-DOC-11, OR-IM-13	CapTOP shall allow the TMC Operator to click on a camera icon off the map display and view video on the local VGA/XVGA computer monitor using software decoding technology for MPEG-2/MPEG-4/H.264 video streams.	C	Demo
CCT-350.8	OR-DOC-11, OR-IM-13	CapTOP shall allow the TMC Operator to select a camera from a pull-down list and view video on any NTSC monitor.	C	Demo
CCT-350.9	OR-DOC-11, OR-IM-13	CapTOP shall allow the TMC Operator to select a camera from a pull-down list and view video on the local VGA/XVGA computer monitor using software decoding technology for MPEG-2/MPEG-4/H.264 video streams.	C	Demo
CCT-350.10	OR-DOC-11, OR-IM-13	CapTOP shall allow the TMC Operator to select a "video not available" input for any camera to block video that DDOT may, from time-to-time, deem sensitive.	C	Demo
CCT-350.11	OR-DOC-11, SR-SYS-23	CapTOP shall allow the System Administrator to add inputs and outputs to the CCTV system without changing the code.	C	Demo
CCT-360	OR-DOC-11, OR-IM-13	CapTOP shall provide an interface to receive and display mobile video images from wireless portable CCTV cameras used by ROP operators.	2	Demo
CCT-370	OR-RTC-13, OR-RTC-14	CapTOP shall be able to route video to share with external agencies.	2	Demo
CCT-380	OR-RTC-13, OR-RTC-14	CapTOP shall be able to stream video to the web to share with Internet users.	2	Demo

3.7.1.1.8 CCTV Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-390	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to produce a report of all scheduled entries for an individual camera or all cameras.	1	Demo
CCT-390.1	OR-DOC-22,	The report shall list all schedule entries, and shall	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-DOC-30	contain the following: a. Schedule name; b. Tour name; c. Message ID; d. Recurrent entry type (optional); e. State Date/Time; f. End Date/Time (optional).		
CCT-400	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status of all cameras.	2	Demo
CCT-400.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the camera status report: a. Camera ID; b. Location; c. Online-offline mode; d. Locked or unlocked status with user name; e. Control mode (central, local, central override); f. Communication status (OK, failed); g. Alarm status.	2	Demo
CCT-410	OR-DWA-7	CapTOP shall be able to produce the following performance reports for evaluating the performance of cameras, using data in the CapTOP operations and archived databases: a. Number of times a camera transitioned from online to offline over a specified time period; b. Number of times a camera transitioned from no device failure to device failure over a specified time period; c. Number of times a camera transitioned from no communication failure to communication failure over a specified time period.	2	Demo
CCT-420	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to display and print the following reports: a. For a user entered CCTV ID, provide a camera history report, consisting of the CCTV ID, date/time last controlled, and username who controlled the camera. b. For a user entered user ID, provide a message history report, consisting of the User ID, CCTV ID, and date/time last commanded. c. For a user entered CCTV ID, provide a full device configuration report; d. For a user specified time-interval, provide a camera history report, consisting of the CCTV ID, date/time last controlled, and username who controlled the camera; e. For a user specified CCTV ID and time interval, provide a camera history report consisting of the control action, date/time of control, and username who controlled the camera f. An ad-hoc report where the user can query	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		any data stored in CCTV related databases.		
CCT-420.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format. c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	a. 2 b. 2 c. 2 d. 2 e. 2 f. 2	Demo

3.7.1.1.9 CCTV Application Interfaces

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-430	OR-IM-1	The CapTOP software shall support an interface to a future incident detection system (a separate system deployed by others) via a TCP interface.	2	Demo
CCT-430.1	OR-IM-1	CapTOP shall have the ability to trigger a macro to be executed based on the receipt of an incident alarm from the incident detection system.	2	Demo
CCT-430.1.1	OR-IM-1	CapTOP shall be able to support the following scenario: a. Receive an external stimulus from the future incident detection system with a Camera-ID or location provided in the message; b. Execute a macro based on an alarm from the incident detection interface that will perform the following: i. select a camera; ii. display the video on the TMC Operator's workstation; iii. move the camera to a predefined preset; iv. route the video to a designated output.	2	Demo

3.7.1.1.10 CCTV Video Recording

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-440	OR-DWA-13	CapTOP shall provide the ability to store traffic video.	1	Demo
CCT-440.1	OR-DWA-13	CapTOP shall provide the ability to route video to the following recording devices: a. Digital Video Recorder (DVR); b. Network Video Recorder (NVR); c. Video Cassette Recorder (VCR).	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-440.2	OR-DWA-13	CapTOP shall provide the ability for the TMC Supervisor to manually perform the following: a. Start recording; b. Stop recording; c. Playback; d. Pause; e. Fast Forward; f. Rewind.	1	Demo
CCT-440.3	OR-DWA-13	CapTOP shall provide the ability for the TMC Operator to manually perform the following: a. Playback; b. Pause; c. Fast Forward; d. Rewind.	1	Demo
CCT-450	OR-DWA-13	CapTOP shall provide the ability for the TMC Operator to display the playback of recorded video on any monitor that can display video.	1	Demo
CCT-460	OR-DWA-13	CapTOP shall allow video to be recorded automatically according to a schedule.	1	Demo
CCT-460.1	OR-DWA-13	The schedule shall permit time of day recurring and non-recurring entries.	1	Demo
CCT-460.2	OR-DWA-13	The schedule shall permit non-recurring, one-time only recording events, where the user specifies a video source, reminder date/time, start time, end time, and recording device.	1	Demo
CCT-460.3	OR-DWA-13	The schedule shall permit any of the following recurring entries: a. Weekdays – Monday through Friday; b. Weekends – Saturday and Sunday only; c. All Days – Monday through Sunday; d. One Day or any combination of days per week; e. One day or any combination of days per month.	1	Demo
CCT-470	OR-DWA-13	CapTOP shall allow the TMC Operator to view a list of the recording schedule through the CapTOP GUI.	1	Demo
CCT-480	OR-DWA-13	CapTOP shall allow the TMC Supervisor to create, edit, and delete schedule entries.	1	Demo
CCT-490	OR-DWA-13	CapTOP shall allow the TMC Supervisor or Operator to manage recorded videos.	1	Demo
CCT-490.1	OR-DWA-13	CapTOP shall allow the TMC Supervisor or Operator to view a sorted inventory of recorded videos.	1	Demo
CCT-490.1.1	OR-DWA-13	CapTOP shall allow the TMC Operator to sort the inventory listing by: a. Camera ID; b. Date/time record.	1	Demo
CCT-490.2	OR-DWA-13	CapTOP shall allow the TMC Supervisor or Operator to retrieve recordings for playback.	1	Demo
CCT-490.3	OR-DWA-13	CapTOP shall allow the TMC Supervisor or Operator to play, start, stop, rewind, fast forward, and pause retrieved recordings.	1	Demo
CCT-490.4	OR-DWA-13	CapTOP shall allow the TMC Supervisor to delete recordings.	1	Demo

3.7.1.1.11 CCTV Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-500	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to CCTV cameras and provide the output in a time sequential log.	C	Demo
CCT-500.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to CCTV cameras: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to a device; c. when the operator issues a command to a CCTV camera; d. when the user changes the CCTV camera configuration data; e. when the user changes presets, tours, and titles. (Note: also refer to the LOG-* requirements).	C	Demo
CCT-500.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to CCTV cameras: a. any system-initiated action that attempts to, or results in, a change to the device; b. when the communication status changes (OK to failed, and failed to OK); c. changes in online-offline mode; d. software application login; e. software application logout. (Note: also refer to the LOG-* requirements).	C	Demo
CCT-500.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for CCTV cameras.	1	Demo
CCT-500.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all CCTV camera activities: a. operator input; b. operator command transmission; c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-500.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the device ID, description of action, and summary status of device).	1	Demo
CCT-500.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action (include the device ID, command type and status of camera prior to transmission).	1	Demo
CCT-500.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo
CCT-510	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to CCTV cameras from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.	1	Demo
CCT-520	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in communication status (OK to failed, and failed to OK); b. changes in control mode (central, local, central override); c. changes in online-offline mode; d. changes to CCTV camera configuration data.	1	Demo

3.7.1.1.12 CCTV Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CCT-530	OR-DWA-13	CapTOP or related third party software shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to CCTV cameras from the log database to the archived database.	1	Demo
CCT-540	OR-DWA-13	CapTOP or related third party software shall have the capability to format and perform automated and manually initiated migration of operations data that	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		pertains to CCTV cameras from the operations database to the archived database.		

3.7.1.2 Traffic Detection Stations

3.7.1.2.1 Accessing the Traffic Detection Station Subsystem

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-10	OR-DOC-1	CapTOP shall allow the TMC Operator to access the traffic detection station subsystem, subject to operator privilege level.	C	Demo
TDS-10.1	OR-DOC-1	CapTOP shall allow the TMC Operator to access the traffic detection station subsystem, using the following mechanisms: a. Left clicking on a traffic detection station icon on the map display; b. Left clicking on the traffic detection station subsystem icon off the CapTOP toolbar; c. Left clicking on the traffic detection station subsystem menu off the CapTOP toolbar.	1	Demo
TDS-10.2	OR-SMM-5, OR-DOC-1	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. Traffic detection station events and alarms; b. Traffic detection station status (refer to TDS-40 and TDS-50); c. Traffic detection station data (refer to TDS-40).	C	Demo
TDS-20	IR-GUI-10	CapTOP shall display all traffic detection station icons on a separate layer on the map-based display.	1	Demo
TDS-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the traffic detection station layer on the map display.	1	Demo
TDS-20.2	IR-GUI-10, IR-GUI-11	CapTOP shall allow a traffic detection station device icon to be left clicked on the map display by the TMC Operator and permit access to the traffic detection station status window (refer to TDS-40 and TDS-50), with no more than 2 additional clicks.	1	Demo
TDS-20.3	IR-GUI-12	The icons used for the traffic detection station icon layer shall be unique from icons used in other layers.	1	Demo
TDS-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify traffic detection station devices from the CapTOP map display (also refer to GUI-200*).	C	Demo
TDS-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new traffic detection station icon using a pop-up menu.	1	Demo
TDS-30.2	IR-GUI-10	When a traffic detection station device icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each traffic detection station device to enable the device to become operational in the system: a. Station Number; b. Controller/Access Point ID; c. Description; d. Controller/Access Point Model Number; e. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Intersection/Interchange. f. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); g. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); h. Collection Mode (count, speed, occupancy, speed/volume/occupancy); i. Communication Type (dialup serial, network serial, IP); j. Group Name; k. Speed Edge (leading edge, trailing edge, average); l. Reporting Filter (enable/disable all vehicle reporting); m. Valid Threshold (limit for valid speed); n. Adaptive Holdover (length in feed for the holdover calculation); o. Clock offset (number of seconds that event times will be shifted before processing); p. Multidrop Information; I. Drop Address; II. Channel ID; III. Port Name. q. IP Information; I. IP Address; II. Port Number; III. Local Port Number; IV. VPN Password. r. Serial Information; I. Baud Rate; II. No. Data Bits; III. Parity;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		IV. No. Stop Bits; V. H/W Flow Control; VI. S/W Flow Control. s. Lane information: I. Number of Lanes; II. For each Lane: i. Lane Number; ii. Direction; iii. Movement (turning lane, through lane, shared lane); iv. Onset Filter; v. Detect Z Threshold; vi. Un-detect Z Threshold; vii. Un-detect X Threshold; viii. Holdover; ix. Swap X/Y (yes/no); x. Stop-bar Recalibrate Timeout; xi. Count Recalibrate Timeout; xii. Distance Between Sensor. t. Time Slot; u. RF Channel; v. Recalibration; w. NTCIP Community; x. Firmware Version; y. Cabinet Number; z. Model Number of Sensor; aa. Protocol; bb. Link ID; cc. Polling Enabled (yes/no, defaults to yes); dd. Comm Loss Timeout (seconds in .1 increments); ee. Associated CCTV; ff. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
TDS-30.2.2	IR-GUI-10	When a traffic detection station device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with setting the device online or offline.	1	Demo
TDS-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-30.3	IR-GUI-10, IR-GUI-11	CapTOP shall allow a traffic detection station device icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. displaying the traffic detection station status window; e. allowing the device icon to be deleted.	1	Demo
TDS-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); h. Online-Offline Mode (online/offline); i. Collection Mode (count, speed, occupancy, speed/volume/occupancy); j. Communication Type (dialup serial, network serial, IP); k. Speed Edge (leading edge, trailing edge, average); l. Reporting Filter (enable/disable all vehicle reporting); m. Direction; n. Movement (turning lane, through lane, shared lane); o. Protocol; p. Link ID; q. Polling Enabled (yes/no, defaults to yes); r. Associated CCTV.	1	Demo
TDS-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
TDS-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
TDS-30.4.3	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.1.2.2 Monitoring Traffic Detection Station Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-40	OR-DOC-10, IR-GUI-14, IR-GUI-16, OR-TDCA-1, UR-TO-25, OR-C2F-1	CapTOP shall allow the TMC Operator to retrieve and display the following operational status and operational data, on a real-time basis, for any traffic detection station, subject to operator privilege level: a. Station number; b. Controller/access point ID; c. Road classification; d. Online-offline mode (static – set by System Administrator or Maintenance Technician); e. Communication status (OK, failed); f. Controller/access point status (OK, failed); g. Average speed, median speed, speed difference average, speed difference 95th percentile, volume, occupancy by lane by direction per last aggregation interval; h. Number of access reboots (loss of synchronization with the access point); i. Stuck high count; j. Down time count; k. Blip count; l. Signal strength average; m. Signal strength standard; n. Link quality indicator average; o. Link quality indicator standard; p. Latency average; q. Latency standard; r. System reboot count; s. Repeater signal strength average (if applicable); t. Repeater signal strength standard (if applicable); u. Repeater link quality indicator average (if applicable); v. Repeater link quality indicator standard (if applicable); w. Last contact (date/time); x. Last communication status change (date/time); y. Alarm status.	C, items h – y priority 1	Demo
TDS-40.1	OR-DOC-1	CapTOP shall be able to upload locally stored data sets from traffic detection stations by interfacing with the Traffic Data Server.	1	Demo
TDS-40.1.1	OR-DOC-1	CapTOP shall allow a privileged user to specify the station number, the starting date/time, and ending date/time of the data set.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-40.2	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the traffic detection stations; b. data gained by CapTOP in attempts to communicate with the traffic detection stations; c. online/offline information entered manually by authorized CapTOP users.	1	Demo
TDS-50	SR-SYS-2, IR-GUI-36, IR-GUI-26	CapTOP shall allow privileged users to simultaneously view traffic detection station status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display; b. Via the traffic detection station status window which lists all traffic detection stations, the station number, controller/access point ID, location, online-offline mode, communication status, and controller/access point status.	C	Demo

TDS-50.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following colors for device icon states:
		a. Black = device failure, but online in CapTOP;
		b. Orange = communication failure;
		c. Gray = offline.
		d. Maroon = online and speed is between 0% and 25% of free flow speed;
		e. Red = online and speed is between 25% and 50% of free flow speed;
		f. Yellow = online and speed is between 50% and 75% of free flow;
		g. Light Green = online and speed is between 75% and 90% of free flow speed;
		h. Dark Green = online and speed is > 90% of free flow speed.
		.
		Also refer to GUI-150* requirements for an understanding of how traffic condition data is displayed on a per link basis.
			C	Demo

TDS-50.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: a. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; b. In order for the device icon to be red, maroon, yellow, light green, or dark green, the device must be both online and have OK communication.	C	Demo
TDS-50.2	IR-GUI-31, IR-GUI-29	The refresh rate for icon status and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
TDS-50.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to TDS-40 items a through g, l, m, and w, x, and y for the list of fields) by hovering over a TDS icon.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-50.4	IR-GUI-29	CapTOP shall allow the user to select on any traffic detection station in the TDS status window (refer to TDS-50 item b) and view all details (full status, configuration information) pertaining to that traffic detection station.	1	Demo
TDS-60	SR-SYS-2, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a traffic detection station by the following methods: a. station number; b. controller/access point ID; c. IP address/drop address/channel ID of the controller/access point; d. group name; e. street name; f. geographical address; g. intersection/interchange.	C	Demo
TDS-60.1	SR-SYS-2, IR-GUI-31	CapTOP shall allow the TMC Operator to search for traffic detection stations using a rubber-band style box on the map display to search an area.	C	Demo
TDS-60.2	SR-SYS-2, IR-GUI-31, OR-TDCA-5	The result of each search shall be a list of traffic detection stations that are sorted, by default, by station number.	1	Demo
TDS-60.3	SR-SYS-2, IR-GUI-31, OR-TDCA-5	The result of each search shall be a list of traffic detection stations sortable by station number, controller/access point ID, IP address/drop address/channel ID, group name, street name, geographical address, and intersection/interchange.	1	Demo
TDS-70	IR-GUI-14	CapTOP shall provide a monitoring interface to the existing traffic detection station server or controller/access point through CapTOP's new Traffic Data Server for monitoring the TDS stations. Refer to TDA-10* for more information.	1	Demo
TDS-70.1	OR-DOC-3, OR-TDCA-6	CapTOP's Traffic Data Server (developed by others, or optionally, by the CapTOP developer) shall interface with the traffic detection station SNAPS (Sensys Networks Archive, Proxy and Statistics) server or controller/access point in accordance with the traffic detection station software API from Sensys, Inc. to access traffic detection station data. Note: DDOT is currently in negotiation with Sensys to obtain proprietary file format and communication protocol documentation for this wireless in-pavement sensor. This requirement is pending based on the results of this effort.	1	Demo
TDS-70.1.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
TDS-70.1.1.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	The default polling interval shall be once every 1 minutes.	1	Demo
TDS-70.2	IR-GUI-14	CapTOP shall be able to request traffic detection station status and obtain status response data through	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		the Traffic Data Server.		
TDS-70.3	IR-GUI-14	CapTOP shall prohibit traffic detection station controller/access point changes through this interface.	1	Demo
TDS-80	OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall be able to store all traffic detection station operational data (refer to TDS-40) in the CapTOP operations database for each polling cycle.	1	Demo
TDS-80.1	OR-TDCA-3	CapTOP shall store the speed, volume, and occupancy data by road name, interchange, and station number.	1	Demo
TDS-80.2	OR-TDCA-3	CapTOP shall be able to use the volumes to compute the Annual Average Daily Traffic (AADT) counts for each year.	1	Demo
TDS-80.3	OR-TDCA-3	CapTOP shall be able to use the volumes to compute the AADT counts for each season of the year.	1	Demo
TDS-90	OR-TDCA-21	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and store all traffic detection station field controller/access point configuration data in the CapTOP central system device configuration database for traffic detection stations.	1	Demo

3.7.1.2.3 Traffic Detection Station Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-100	OR-TDCA-4, OR-TDCA-9	CapTOP shall be able to display and print data from traffic detection stations in both tabular and graphical formats.	2	Demo
TDS-110	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status and operational data of all traffic detection stations.	2	Demo
TDS-110.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the traffic detection station status summary report: a. Station number; b. Controller/access point ID; c. Location; d. Number of lanes; e. Alarm status; f. Online-offline mode; g. Controller/access point status (OK, failed); h. Communication status (OK, failed).	2	Demo
TDS-110.2	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the traffic detection station extended status report: a. Station number; b. Controller/access point ID; c. Location; d. Road classification; e. Online-offline mode (static – set by System Administrator or Maintenance Technician); f. Communication status (OK, failed); g. Controller/access point status (OK, failed); h. Number of lanes; i. Average speed, median speed, speed	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		difference average, speed difference 95th percentile, volume, and occupancy by lane by direction per last aggregation interval; j. Last contact (date/time); k. Last communication status change (date/time); l. Alarm status.		
TDS-110.2.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format using data in the extended status report.	2	Demo
TDS-110.3	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to provide a full device configuration report for a user entered Station number or Controller ID.	2	Demo
TDS-120	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce the following performance reports for evaluating the performance of traffic detection stations, using data in the CapTOP operations and archived databases: a. Number of times a traffic detection station transitioned from online to offline over a specified time period; b. Number of times a traffic detection station transitioned from no device failure to device failure over a specified time period; c. Number of times a traffic detection station transitioned from no communication to communication failure over a specified time period; d. A report showing missing data from each traffic detection station.	2	Demo
TDS-130	OR-DWA-7, OW-DWA-5	CapTOP shall be able to produce a traffic detection station report by allowing the user to specify a station number, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual).	2	Demo
TDS-140	OR-DWA-7, OW-DWA-5	CapTOP shall be able to produce the following reports by allowing the user to specify a station number, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual): a. Speed Peak Period Average; b. Speed Daily Average; c. Speed Weekly Average; d. Speed Monthly Average; e. Volume Peak Period Average; f. Volume Daily Average; g. Volume Weekly Average; h. Volume Monthly Average; i. Occupancy Peak Period Average; j. Occupancy Daily Average; k. Occupancy Weekly Average; l. Occupancy Monthly Average.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-150	OR-DWA-7, OW-DWA-5	CapTOP shall allow the operator to search for data by specifying any of the following: a. Station number; b. Controller/access point ID; c. Description; d. Location; e. Road classification; f. IP address/drop address/channel ID; g. Group name; h. Drop address; i. Starting date/time; j. Ending date/time; k. Type of data (speed, volume, occupancy); l. Number of lanes; m. Lane number; n. User specified speed, volume or occupancy; o. Reporting interval; p. Lane type (turning movement, non-turning movement).	2	Demo
TDS-160	OR-DWA-7, OW-DWA-5	CapTOP shall support an ad-hoc report generation capability that allows the user to build and specify their own queries based on data stored in TDS related databases.	2	Demo
TDS-160.1	OR-TDCA-2	CapTOP shall be able to aggregate speed, volume, and occupancy data on-the-fly from traffic detection stations in the CapTOP operations database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
TDS-160.2	OR-TDCA-2	CapTOP shall be able to store aggregated speed, volume, and occupancy data from traffic detection stations in a Microsoft Excel format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
TDS-160.3	OR-TDCA-2	CapTOP shall be able to store aggregated speed, volume, and occupancy data from traffic detection stations in a CSV (Comma Separated Value) file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
TDS-160.4	OR-TDCA-2	CapTOP shall be able to store aggregated speed, volume, and occupancy data from traffic detection stations in a text file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
TDS-170	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format; c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.		

3.7.1.2.4 Traffic Detection Station Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-180	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to traffic detection stations and provide the output in a time sequential log.	C	Demo
TDS-180.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to traffic detection stations: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to a device; c. when the user changes the traffic detection station configuration data; d. operator login; e. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo
TDS-180.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to traffic detection stations: a. any system-initiated action that attempts to, or results in, a change to the device; b. when the communication status changes (OK to failed, and failed to OK); c. changes in online-offline mode; d. software application login; e. software application logout; f. database login; g. database logout. (Note: also refer to the LOG-* requirements).	1	Demo
TDS-180.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for traffic detection stations.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-180.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all traffic detection station activities: a. operator input; b. operator command transmission (if applicable); c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.	1	Demo
TDS-180.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the device ID, description of action, and summary status of device).	1	Demo
TDS-180.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
TDS-180.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo
TDS-190	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to traffic detection stations from the log by filtering on the following: a. workstation ID; b. workstation IP address; c. username; d. date stamp; e. time stamp; f. action type.	1	Demo
TDS-200	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in communication status (OK to failed, and failed to OK); b. changes in online-offline mode; c. changes to traffic detection station configuration data.	1	Demo

3.7.1.2.5 Traffic Detection Station Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDS-210	OR-DWA-13	CapTOP or related third party software shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to traffic detection stations from the log database to the archived database.	1	Demo
TDS-220	OR-DWA-13	CapTOP or related third party software shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to traffic detection stations from the operations database to the archived database.	1	Demo
TDS-220.1	OR-TDCA-1, OR-TDCA-2, OR-TDCA-3	CapTOP shall be able to store aggregated speed, volume, and occupancy data from traffic detection stations in the CapTOP archived database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo

3.7.1.3 Permanent Count Stations

3.7.1.3.1 Accessing the Permanent Count Station Subsystem

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-10	OR-DOC-1	CapTOP shall allow the TMC Operator to access the permanent count station subsystem, subject to operator privilege level.	C	Demo
PCS-10.1	OR-DOC-1	CapTOP shall allow the TMC Operator to access the permanent count station subsystem, using the following mechanisms: a. Left clicking on a permanent count station icon on the map display; b. Left clicking on the permanent count station subsystem icon off the CapTOP toolbar; c. Left clicking on the permanent count station subsystem menu off the CapTOP toolbar.	1	Demo
PCS-10.2	OR-SMM-5, OR-DOC-1	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. Permanent count station events and alarms; b. Permanent count station status (refer to PCS-40 and PCS-50); c. Permanent count station data (refer to PCS-40).	C	Demo
PCS-20	IR-GUI-10	CapTOP shall display all permanent count station icons on a separate layer on the map-based display.	1	Demo
PCS-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the permanent count station layer on the map display.	1	Demo
PCS-20.2	IR-GUI-11	CapTOP shall allow the TMC Operator to left click a permanent count station icon and invoke the permanent count station status window (refer to PCS-40 and PCS-50), with no more than 2 additional clicks.	1	Demo
PCS-20.3	IR-GUI-12	The icons used for the permanent count station icon layer shall be unique from icons used in other layers.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify permanent count station devices from the CapTOP map display (also refer to GUI-200*).	C	Demo
PCS-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new permanent count station icon using a pop-up menu.	1	Demo
PCS-30.2	IR-GUI-10	When a permanent count station device icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	1	Demo
PCS-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each permanent count station device to enable the device to become operational in the system: a. Station Number; b. Station Type (portable, permanent); c. Controller ID; d. Description; e. Controller Model Number; f. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Intersection/Interchange. g. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); h. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); i. Communication Type (dialup serial, network serial, IP); j. Multidrop Information; I. Drop Address; II. Channel ID; III. Port Name. k. IP Information; I. IP Address; II. Port Number. l. Serial Information; I. Baud Rate; II. No. Data Bits; III. Parity; IV. No. Stop Bits; V. H/W Flow Control; VI. S/W Flow Control. m. Classification information: I. Number of classes;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		II. For each class: i. Class Number; ii. Number of axles; iii. Minimum length of axle; iv. Maximum length of axle. n. Lane information: I. Number of lanes; II. For each lane: i. Lane Number; ii. Direction; iii. Movement (turning lane, through lane, shared lane); iv. Occupancy error; v. Distance between loops. o. NTCIP Community; p. Firmware Version; q. Cabinet Number; r. Model Number of Sensor; s. Protocol; t. Link ID; u. Polling Enabled (yes/no, defaults to yes); v. Comm Loss Timeout (seconds in .1 increments); w. Associated CCTV; x. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
PCS-30.2.2	IR-GUI-10	When a permanent count station device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with setting the device online or offline.	1	Demo
PCS-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-30.3	IR-GUI-10	CapTOP shall allow a permanent count station device icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. allowing the device icon to be deleted.	1	Demo
PCS-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); h. Online-Offline Mode (online/offline); i. Collection Mode (count, speed, occupancy, speed/volume/occupancy); j. Communication Type (dialup serial, network serial, IP); k. Direction; l. Movement (turning lane, through lane, shared lane); m. Protocol; n. Link ID; o. Polling Enabled (yes/no, defaults to yes); p. Associated CCTV.	1	Demo
PCS-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
PCS-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
PCS-30.4.3	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.1.3.2 Monitoring Permanent Count Station Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-40	OR-DOC-10, IR-GUI-14, IR-GUI-16, OR-TDCA-6, UR-TO-25, OR-C2F-1	CapTOP shall allow the TMC Operator to retrieve and display the following operational status and operational data, on a real-time basis, from any permanent count station, subject to operator privilege level: a. Station number; b. Controller ID; c. Station type (portable, permanent); d. Road classification; e. Online-offline mode (static – set by System Administrator or Maintenance Technician); f. Communication status (OK, failed); g. Controller status (OK, failed); h. Speed, volume, occupancy by lane and by direction per last aggregation interval; i. Classification data by lane and by direction per last aggregation interval; j. Lane status (OK, failed, standby); k. Last contact (date/time); l. Last communication status change (date/time); m. Alarm status.	C, items i - m priority 1	Demo
PCS-40.1	OR-DOC-1	CapTOP shall be able to upload locally stored data sets from permanent count stations by interfacing with the Traffic Data Server.	1	Demo
PCS-40.1.1	OR-DOC-1	CapTOP shall allow a privileged user to specify the station number, the starting date/time, and ending date/time of the data set.	1	Demo
PCS-40.2	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the permanent count stations; b. data gained by CapTOP in attempts to communicate with the permanent count stations; c. online/offline information entered manually by authorized CapTOP users.	1	Demo
PCS-50	SR-SYS-2, IR-GUI-36, IR-GUI-26	CapTOP shall allow privileged users to simultaneously view permanent count station status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display; b. Via the permanent count station status window which lists all permanent count stations, the station number, controller ID, location, online-offline mode, communication status, and controller status.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method

PCS-50.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following colors for device icon states:
		a. Black = device failure, but online in CapTOP;
		b. Orange = communication failure;
		c. Flashing Orange = device in Standby;
		d. Gray = offline.
		e. Maroon = online and speed is between 0% and 25% of free flow speed;
		f. Red = online and speed is between 25% and 50% of free flow speed;
		g. Yellow = online and speed is between 50% and 75% of free flow;
		h. Light Green = online and speed is between 75% and 90% of free flow speed;
		i. Dark Green = online and speed is > 90% of free flow speed.
		
		Also refer to GUI-150* requirements for an understanding of how traffic condition data is displayed on a per link basis.
			C	Demo

PCS-50.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: a. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; b. In order for the device icon to be red, maroon, yellow, light green, or dark green, the device must be both online and have OK communication.	C	Demo
PCS-50.2	IR-GUI-31, IR-GUI-29	The refresh rate for the status of the icons and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
PCS-50.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to PCS-40 for the list of fields) by hovering over a PCS icon.	1	Demo
PCS-50.4	IR-GUI-29	CapTOP shall allow the user to select on any permanent count station in the PCS status window (refer to PCS-50 item b) and view all details (full status, configuration information) pertaining to that permanent count station.	1	Demo
PCS-60	SR-SYS-2, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a permanent count station by the following methods: a. station number; b. controller ID; c. IP address/drop address/channel ID of the controller; d. street name; e. geographical address; f. intersection/interchange.	C	Demo
PCS-60.1	SR-SYS-2, IR-GUI-31	CapTOP shall allow the TMC Operator to search for permanent count stations using a rubber-band style box on the map display to search an area.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-60.2	SR-SYS-2, IR-GUI-31, OR-TDCA-10	The result of each search shall be a list of permanent count stations that are sorted, by default, by station number.	1	Demo
PCS-60.3	SR-SYS-2, IR-GUI-31, OR-TDCA-10	The result of each search shall be a list of permanent count stations sortable by station number, controller ID, IP address/drop address/channel ID, street name, geographical address, and intersection/interchange.	1	Demo
PCS-70	IR-GUI-14	CapTOP shall provide a monitoring interface to the existing permanent count station server through CapTOP's new Traffic Data Server for monitoring the PCS stations. Refer to TDA-10* for more information.	C	Demo
PCS-70.1	OR-DOC-3, OR-TDCA-6	CapTOP's Traffic Data Server (developed by others, or optionally, by the CapTOP developer) shall interface with the following existing count station servers to access permanent count station data in accordance with the permanent count station software APIs from each vendor: a. Loop/piezo system; b. Video system from Traficon USA LLC; c. RTMS from Electronic Integrated Systems (EIS), Inc.; d. IR-based TIRTL system from Tec Traffic Systems; e. Acoustic-based system (SAS-1) from SmarTek, Inc.	1	Demo
PCS-70.1.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
PCS-70.2	IR-GUI-14	CapTOP shall be able to request permanent count station status and obtain status response data through the Traffic Data Server.	1	Demo
PCS-70.3	IR-GUI-14	CapTOP shall prohibit permanent count station controller changes through this interface.	1	Demo
PCS-80	OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall be able to store all permanent count station operational data (refer to PCS-40) in the CapTOP operations database for each polling cycle.	1	Demo
PCS-80.1	OR-TDCA-8	CapTOP shall store the speed, volume, occupancy, and classification data by road name, interchange, and station number.	1	Demo
PCS-80.2	OR-TDCA-8	CapTOP shall be able to use the volumes to compute the Annual Average Daily Traffic (AADT) counts for each year.	1	Demo
PCS-80.3	OR-TDCA-8	CapTOP shall be able to use the volumes to compute the AADT counts for each season of the year.	1	Demo
PCS-90	OR-TDCA-21	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and store all permanent count station field controller configuration data in the CapTOP central system device configuration database for permanent count stations.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-100	IR-GUI-28	CapTOP shall provide the TMC Operator with a map-based display to indicate which count stations are in standby-mode and which are in non-standby mode. (Refer to PCS-60).	1	Demo

3.7.1.3.3 Permanent Count Station Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-110	OR-TDCA-4, OR-TDCA-9	CapTOP shall be able to display and print data from permanent count stations in both tabular and graphical formats.	2	Demo
PCS-120	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status and operational data of all permanent count stations.	2	Demo
PCS-120.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the permanent count station status summary report: a. Station number; b. Controller ID; c. Location; d. Number of lanes; e. Alarm status; f. Online-offline mode; g. Controller status (OK, failed); h. Communication status (OK, failed).	2	Demo
PCS-120.2.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format using data in the extended status report.	2	Demo
PCS-120.2	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the permanent count station extended status report: a. Station number; b. Controller ID; c. Location; d. Station type (portable, permanent); e. Road classification; f. Online-offline mode (static – set by System Administrator or Maintenance Technician); g. Communication status (OK, failed); h. Controller status (OK, failed); i. Number of lanes; j. Lane status (OK, failed, standby); k. Speed, volume, and occupancy by lane by direction per last aggregation interval; l. Classification data by lane and by direction per last aggregation interval; m. Last contact (date/time); n. Last communication status change (date/time); o. Alarm status.	2	Demo
PCS-120.3	SR-SYS-22,	CapTOP shall be able to provide a full device	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	SR-SYS-36, OR-DOC-4, IR-GUI-8	configuration report for a user entered Station number or Controller ID.		
PCS-130	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce the following performance reports for evaluating the performance of permanent count stations, using data in the CapTOP operations and archived databases: a. Number of times a permanent count station transitioned from online to offline over a specified time period; b. Number of times a permanent count station transitioned from no device failure to device failure over a specified time period; c. Number of times a permanent count station transitioned from no communication to communication failure over a specified time period; d. A report showing missing data from each permanent count station.	2	Demo
PCS-140	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce a vehicle classification report by allowing the user to specify a station number, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual).	2	Demo
PCS-140.1	OR-DWA-7, OR-DWA-5	CapTOP shall support all 15 FHWA classification categories when producing vehicle classification reports: 1. Motorcycle; 2. 2 axle passenger car including 1 and 2 axle trailers; 3. 2 axle light truck including 1 and 2 axle trailers; 4. 2 axle or 3 axle Bus; 5. 2 axle single-unit truck; 6. 3 axle single-unit truck; 7. 4 or more axle single-unit truck; 8. 3 and 4 axle single-trailer truck; 9. 5 axle single-trailer truck; 10. 6 or more axle single-trailer truck; 11. 5 or less multi-trailer truck; 12. 6 axle multi-trailer truck; 13. 7 axle multi-trailer truck; 14. Not used; 15. Unknown.	2	Demo
PCS-150	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce the following reports by allowing the user to specify a station number, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual): a. Truck % Peak Period Average; b. Truck % Daily Average; c. Truck % Weekly Average; d. Truck % Monthly Average; e. Speed Peak Period Average;	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		f. Speed Daily Average; g. Speed Weekly Average; h. Speed Monthly Average; i. Volume Peak Period Average; j. Volume Daily Average; k. Volume Weekly Average; l. Volume Monthly Average.		
PCS-160	OR-DWA-7, OR-DWA-5	CapTOP shall allow the operator to search for data by specifying any of the following: a. Station number; b. Station type (portable, permanent); c. Controller ID; d. Description; e. Location; f. Road classification; g. IP address/drop address/channel ID; h. Starting date/time; i. Ending date/time; j. Type of data (speed, volume, occupancy, classification); k. Number of lanes; l. Lane number; m. Number of classes; n. Classification class; o. User specified speed, volume, occupancy, or classification; p. Reporting interval; q. Count type (turning movement, through lane, shared lane).	2	Demo
PCS-160.1	OR-TDCA-7	CapTOP shall be able to aggregate speed, volume, occupancy, and classification data on-the-fly from permanent count stations in the CapTOP operations database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
PCS-160.2	OR-TDCA-7	CapTOP shall be able to store aggregated speed, volume, occupancy, and classification data from permanent count stations in a Microsoft Excel format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
PCS-160.3	OR-TDCA-7	CapTOP shall be able to store aggregated speed, volume, occupancy, and classification data from permanent count stations in a CSV (Comma Separated Value) file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
PCS-160.4	OR-TDCA-7	CapTOP shall be able to store aggregated speed, volume, occupancy, and classification data from permanent count stations in a text file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
PCS-170	OR-DWA-7, OW-DWA-5	CapTOP shall support an ad-hoc report generation capability that allows the user to build and specify their own queries based on data stored in PCS related databases.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-180	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format; c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	a. 2 b. 2 c. 2 d. 2 e. 2 f. 2	Demo

3.7.1.3.4 Permanent Count Station Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-190	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to permanent count stations and provide the output in a time sequential log.	C	Demo
PCS-190.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to permanent count stations: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to a device; c. when the user changes the permanent count station configuration data; d. operator login; e. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo
PCS-190.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to permanent count stations: a. any system-initiated action that attempts to, or results in, a change to the device; b. when the communication status changes (OK to failed, and failed to OK); c. changes in online-offline mode; d. software application login; e. software application logout; f. database login; g. database logout. (Note: also refer to the LOG-* requirements).	1	Demo
PCS-190.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for permanent count stations.	1	Demo
PCS-190.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all permanent count station	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		activities: a. operator input; b. operator command transmission (if applicable); c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.		
PCS-190.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the device ID, description of action, and summary status of device).	1	Demo
PCS-190.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
PCS-190.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo
PCS-200	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to permanent count stations from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.	1	Demo
PCS-210	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in communication status (OK to failed, and failed to OK); b. changes in online-offline mode; c. changes to permanent count station configuration data.	1	Demo

3.7.1.3.5 Permanent Count Station Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PCS-220	OR-DWA-13	CapTOP related third party software shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to permanent count stations from the log database to the archived database.	1	Demo
PCS-230	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to permanent count stations from the operations database to the archived database.	1	Demo
PCS-230.1	OR-TDCA-7	CapTOP shall be able to store aggregated speed, volume, occupancy, and classification data from permanent count stations in the CapTOP archived database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo

3.7.1.4 Congestion Alerts

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CGA-10	OR-TID-6	CapTOP shall have the ability to generate pop-up congestion alerts for DDOT's freeways and freeway-like arterials.	1	Demo
CGA-10.1	OR-TID-6	CapTOP shall have the ability for the System Administrator to define speed, volume, and occupancy congestion thresholds that are location-specific.	1	Demo
CGA-10.1.1	OR-TID-6	The CapTOP congestion thresholds shall be maintained on a per-link basis for freeway and freeway-like arterials only, where data is available from any of the following: a. Traffic Detection Stations; b. Permanent Count Stations; c. Traffic.com Stations; d. SpeedInfo.com Stations; e. Inrix links; f. Future sensor types.	1	Demo
CGA-10.1.2	OR-TID-6	CapTOP shall prevent the System Administrator from defining a link speed, volume, or occupancy threshold if there is not a least one sensor on the link to provide the required data.	1	Demo
CGA-10.2	OR-TID-6	CapTOP shall define thresholds where each threshold parameter is configurable by the TMC Manager or System Administrator per location and has default values defined with guidance on expected detection times and false alarm rates:: a. Speed Threshold, defined based on current and expected speed data; b. Volume Threshold, defined based on current and expected volume data; c. Occupancy Threshold, defined based on current and expected occupancy data	1	Demo
CGA-10.2.1	OR-TID-6	CapTOP shall allow a single threshold to be defined	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		that is any combination of speed, volume, and occupancy thresholds.		
CGA-10.3	OR-TID-6	The CapTOP alert that is generated when a threshold is exceeded shall provide a pop-up alert to the operator that must be acknowledged.	1	Demo
CGA-10.3.1	OR-TID-6, UR-TO-14	The alert shall provide a button that says display closest CCTV camera and when selected allows the user to view and control the CCTV camera closest to the area of congestion.	1	Demo
CGA-10.4	OR-TID-6	For each alert generated, CapTOP shall generate a system event log entry (refer to INM-430*) that logs the link-id, threshold type exceeded, current date, current time, and current speed, volume, and occupancy readings for that link.	1	Demo
CGA-10.5	OR-TID-6	CapTOP shall not generate an alert for a threshold until the threshold has been exceeded a minimum of N consecutive polling cycles, where N has a default value of 5 cycles, and where N is a value that is configurable by the System Administrator.	1	Demo
CGA-10.5.1	OR-TID-6	CapTOP shall not generate subsequent threshold alerts for a link, until the congestion clears and none of the thresholds associated with a link are exceeded for a minimum of M minutes, where M has a default value of 30 minutes, and where M is a value that is configurable by the System Administrator.	1	Demo
CGA-10.6	OR-TID-6	The CapTOP congestion alert capability shall have a global system parameter that allows the System Administrator or TMC Manager to enable and disable this capability.	1	Demo
CGA-10.7	OR-TID-6	The CapTOP congestion alert capability shall allow the System Administrator or TMC Manager to enable or disable this capability in advance based on day of week and time of day using the CapTOP scheduler capability (refer to GUI-350).	1	Demo
CGA-10.8	OR-TID-6	The CapTOP congestion alert capability shall allow the System Administrator or TMC Manager to enable weather checking to automatically enable/disable congestion alerts during inclement weather.	1	Demo
CGA-10.8.1	OR-TID-6	If weather checking is enabled, the congestion alert capability shall automatically obtain the current weather status from CapTOP's RWIS data to determine if inclement weather (fog, snow, ice, rain, sleet) is present.	1	Demo
CGA-10.8.2	OR-TID-6	The congestion alert capability shall disable congestion alerts if the weather is inclement and not re-enable until inclement weather is eliminated for a minimum of 30 minutes.	1	Demo

3.7.1.5 Traffic.Com Interface

3.7.1.5.1 Accessing the Traffic.Com Interface Subsystem

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-10	OR-DOC-1	CapTOP shall allow the TMC Operator to access the Traffic.Com interface subsystem, subject to operator privilege level.	C	Demo
TDC-10.1	OR-DOC-1	CapTOP shall allow the TMC Operator to access the Traffic.Com interface subsystem, using the following mechanisms: a. Left clicking on a Traffic.Com station icon on the map display; b. Left clicking on the Traffic.Com interface subsystem icon off the CapTOP toolbar; c. Left clicking on the Traffic.Com interface subsystem menu off the CapTOP toolbar.	1	Demo
TDC-10.2	OR-SMM-5, OR-DOC-1	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. Traffic.Com station events and alarms; b. Traffic.Com station status (refer to TDC-40 and TDC-50); c. Traffic.Com station data (refer to TDC-40).	C	Demo
TDC-20	IR-GUI-10	CapTOP shall display all Traffic.Com station icons on a separate layer on the map-based display.	1	Demo
TDC-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the Traffic.Com station layer on the map display.	1	Demo
TDC-20.2	IR-GUI-10, IR-GUI-11	CapTOP shall allow a Traffic.Com station icon to be left clicked on the map display by the TMC Operator and permit access to the Traffic.Com station status window (refer to TDC-40 and TDC-50), with no more than 2 additional clicks.	1	Demo
TDC-20.3	IR-GUI-12	The icons used for the Traffic.Com station icon layer shall be unique from icons used in other layers.	1	Demo
TDC-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify Traffic.Com stations from the CapTOP map display (also refer to GUI-200*).	C	Demo
TDC-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new Traffic.Com station icon using a pop-up menu.	1	Demo
TDC-30.2	IR-GUI-10	When a Traffic.Com station icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	1	Demo
TDC-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each Traffic.Com station to enable the device to become operational in the system: a. Station Number; b. Detector ID; c. Description; d. Detector Model Number; e. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		VII. Intersection/Interchange. f. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); g. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); h. Group Name; i. Lane information: I. Number of Lanes; II. For each Lane: i. Lane Number; ii. Direction; iii. Movement (turning lane, through lane, shared lane). j. Model Number of Sensor; k. Protocol; l. Link ID; m. Polling Enabled (yes/no, defaults to yes); n. Associated CCTV; o. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
TDC - 30.2.2	IR-GUI-10	When a Traffic.Com station device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with setting the device online or offline.	1	Demo
TDC-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo
TDC-30.3	IR-GUI-10, IR-GUI-11	CapTOP shall allow a Traffic.Com station icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. displaying the Traffic.Com station status window; e. allowing the device icon to be deleted.	1	Demo
TDC-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); h. Online-Offline Mode (online/offline); i. Protocol; j. Link ID; k. Polling Enabled (yes/no, defaults to yes); l. Associated CCTV.		
TDC-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
TDC-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
TDC-30.4.3	OR-IM-4	CapTOP shall allow the user to select "Other" and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.1.5.2 Monitoring Traffic.Com Station Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-40	OR-DOC-10, IR-GUI-14, IR-GUI-16, OR-TDCA-1, UR-TO-25, OR-TDCA-15, OR-C2F-1	CapTOP shall allow the TMC Operator to retrieve and display the following operational status and operational data, on a real-time basis, for any Traffic.Com station, subject to operator privilege level: a. Station number; b. Detector ID; c. Road classification; d. Online-offline mode (static – set by System Administrator or Maintenance Technician); e. Traffic.com server status (OK, failed); f. Detector status (OK, failed); g. Average speed, volume, and occupancy by lane by direction per last aggregation interval; h. Last contact (date/time stamp on data); i. Last Traffic.com server status change (date/time).	C	Demo
TDC-40.1	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the Traffic.com server; b. data gained by CapTOP in attempts to communicate with the Traffic.com server; c. online/offline information entered manually by authorized CapTOP users.	C	Demo
TDC-50	SR-SYS-2, IR-GUI-36, IR-GUI-26	CapTOP shall allow privileged users to simultaneously view Traffic.Com station status, which is refreshed automatically by the system based on the polling interval, using the following methods:	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		a. Color coded icons on the map display; b. Via the Traffic.Com station status window which lists all Traffic.Com stations, the station number, Detector ID, location, direction, online-offline mode, Traffic.com server status, and detector status.		

TDC-50.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following colors for device icon states:
		a. Black = device failure, but online in CapTOP;
		b. Orange = communication failure;
		c. Gray = offline.
		d. Maroon = online and speed is between 0% and 25% of free flow speed;
		e. Red = online and speed is between 25% and 50% of free flow speed;
		f. Yellow = online and speed is between 50% and 75% of free flow;
		g. Light Green = online and speed is between 75% and 90% of free flow speed;
		h. Dark Green = online and speed is > 90% of free flow speed.
		
		Also refer to GUI-150* requirements for an understanding of how traffic condition data is displayed on a per link basis.
			C	Demo

TDC-50.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: c. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; d. In order for the device icon to be red, maroon, yellow, light green, or dark green, the device must be both online and have OK communication.	C	Demo
TDC-50.2	IR-GUI-31, IR-GUI-29	The refresh rate for icon status and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
TDC-50.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to TDC-40 for the list of fields) by hovering over a Traffic.com icon.	1	Demo
TDC-50.4	IR-GUI-29	CapTOP shall allow the user to select on any Traffic.Com station in the Traffic.com status window (refer to TDC-50 item b) and view all details (full status, configuration information) pertaining to that Traffic.Com station.	1	Demo
TDC-60	SR-SYS-2, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a Traffic.Com station by the following methods: a. station number; b. detector ID; c. group name; d. street name; e. geographical address; f. intersection/interchange.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-60.1	SR-SYS-2, IR-GUI-31	CapTOP shall allow the TMC Operator to search for Traffic.Com stations using a rubber-band style box on the map display to search an area.	C	Demo
TDC-60.2	SR-SYS-2, IR-GUI-31	The result of each search shall be a list of Traffic.Com stations that are sorted, by default, by station number.	1	Demo
TDC-60.3	SR-SYS-2, IR-GUI-31, OR-TDCA-18	The result of each search shall be a list of Traffic.Com stations sortable by station number, detector ID, group name, street name, geographical address, and intersection/interchange.	1	Demo
TDC-70	IR-GUI-14	CapTOP shall provide a monitoring interface to Traffic.com's existing remote server through CapTOP's new Traffic Data Server for monitoring the Traffic.com stations. Refer to TDA-10* for more information.	C	Demo
TDC-70.1	OR-DOC-3, OR-TDCA-6	CapTOP's Traffic Data Server (developed by others, or optionally, by the CapTOP developer) shall interface with the Traffic.Com remote server in accordance with the Traffic.com XML Format document, dated January 2007.	1	Demo
TDC-70.1.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
TDC-70.1.1.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	The default polling interval shall be once every 3 minutes.	1	Demo
TDC-70.2	IR-GUI-14	CapTOP shall be able to request Traffic.Com station status and obtain status response data through the Traffic Data Server.	1	Demo
TDC-70.3	IR-GUI-14	CapTOP shall prohibit Traffic.Com detector changes through this interface.	1	Demo
TDC-80	OR-C2F-3, OR-C2F-4, OR-DWA-13, OR-TDCA-16	CapTOP shall be able to store all Traffic.Com stations operational data (refer to TDC-40) in the CapTOP operations database for each polling cycle.	1	Demo
TDC-90	OR-TDCA-3	CapTOP shall store the speed, volume, and occupancy data by road name, interchange, direction, detector ID, and station number.	1	Demo

3.7.1.5.3 Traffic.Com Station Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-100	OR-TDCA-4, OR-TDCA-17	CapTOP shall be able to display and print data from Traffic.Com stations in both tabular and graphical formats.	2	Demo
TDC-110	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status and operational data of all Traffic.Com stations.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-110.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the Traffic.Com station status summary report: a. Station number; b. Detector ID; c. Location; d. Road Direction; e. Number of lanes; f. Online-offline mode; g. Detector status (OK, failed); h. Traffic.com server status (OK, failed).	2	Demo
TDC-110.2	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the Traffic.Com station extended status report: a. Station number; b. Detector ID; c. Location; d. Road Direction; e. Road classification; f. Online-offline mode (static – set by System Administrator or Maintenance Technician); g. Traffic.com server status (OK, failed); h. Detector status (OK, failed); i. Number of lanes; j. Average speed, volume, and occupancy by lane by direction per last aggregation interval; k. Last contact (date/time stamp on data); l. Last Traffic.com server status change (date/time).	2	Demo
TDC-110.2.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format using data in the extended status report.	2	Demo
TDC-110.3	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to provide a full device configuration report for a user entered Station number or Detector ID.	2	Demo
TDC-120	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce the following performance reports for evaluating the performance of Traffic.Com stations, using data in the CapTOP operations and archived databases: a. Number of times a Traffic.com station transitioned from online to offline over a specified time period; b. Number of times a Traffic.com detector ID status transitioned from OK to failed over a specified time period; c. Number of times a Traffic.com server status transitioned from OK to failed over a specified time period; d. A report showing missing data from each traffic detection station.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-130	OR-DWA-7, OW-DWA-5	CapTOP shall be able to produce a Traffic.Com station report by allowing the user to specify a station number, detector ID, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual).	2	Demo
TDC-140	OR-DWA-7, OW-DWA-5	CapTOP shall be able to produce the following reports by allowing the user to specify a station number, detector ID, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual): a. Speed Peak Period Average; b. Speed Daily Average; c. Speed Weekly Average; d. Speed Monthly Average; e. Volume Peak Period Average; f. Volume Daily Average; g. Volume Weekly Average; h. Volume Monthly Average; i. Occupancy Peak Period Average; j. Occupancy Daily Average; k. Occupancy Weekly Average; l. Occupancy Monthly Average.	2	Demo
TDC-150	OR-DWA-7, OW-DWA-5	CapTOP shall allow the operator to search for data by specifying any of the following: a. Station number; b. Detector ID; c. Description; d. Location; e. Road Direction; f. Road classification; g. Group name; h. Starting date/time; i. Ending date/time; j. Type of data (speed, volume, occupancy); k. Number of lanes; l. Lane number; m. User specified speed, volume or occupancy; n. Reporting interval; o. Lane type (turning movement, non-turning movement).	2	Demo
TDC-160	OR-DWA-7, OW-DWA-5	CapTOP shall support an ad-hoc report generation capability that allows the user to build and specify their own queries based on data stored in Traffic.com-related databases.	2	Demo
TDC-160.1	OR-TDCA-2	CapTOP shall be able to aggregate speed, volume, and occupancy data on-the-fly from Traffic.Com stations in the CapTOP operations database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
TDC-160.2	OR-TDCA-2	CapTOP shall be able to store aggregated speed, volume, and occupancy data from Traffic.Com stations in a Microsoft Excel format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-160.3	OR-TDCA-2	CapTOP shall be able to store aggregated speed, volume, and occupancy data from Traffic.Com stations in a CSV (Comma Separated Value) file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
TDC-160.4	OR-TDCA-2	CapTOP shall be able to store aggregated speed, volume, and occupancy data from Traffic.Com stations in a text file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
TDC-170	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format; c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	a. 2 b. 2 c. 2 d. 2 e. 2 f. 2	Demo

3.7.1.5.4 Traffic.Com Station Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-180	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to Traffic.Com stations and provide the output in a time sequential log.	C	Demo
TDC-180.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to Traffic.Com stations: a. any operator-initiated action resulting in a request to access information; b. when the user changes the Traffic.Com station configuration data; c. operator login; d. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo
TDC-180.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to Traffic.Com stations: a. any system-initiated action that attempts to, or results in, a change to the CapTOP configuration data; b. when the Traffic.com server status changes (OK to failed, and failed to OK); c. when detector ID status changes (OK to failed, and failed to OK);	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		d. changes in online-offline mode; e. software application login; f. software application logout; g. database login; h. database logout. (Note: also refer to the LOG-* requirements).		
TDC-180.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for Traffic.Com stations.	1	Demo
TDC-180.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all Traffic.Com station activities: a. operator input; b. operator informational message; c. operator error; d. system warning; e. system error; f. system information message; g. software application warning; h. software application error; i. software application information message.	1	Demo
TDC-180.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the device ID, description of action, and summary status of device).	1	Demo
TDC-180.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
TDC-180.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo
TDC-190	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to Traffic.Com stations from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-200	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in Traffic.com server status (OK to failed, and failed to OK); b. changes in online-offline mode; c. changes to Traffic.Com station configuration data; d. when a detector ID status changes to out-of-service.	1	Demo

3.7.1.5.5 Traffic.Com Station Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
TDC-210	OR-DWA-13	CapTOP or related third party software shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to Traffic.Com stations from the log database to the archived database.	1	Demo
TDC-220	OR-DWA-13	CapTOP or related third party software shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to Traffic.Com stations from the operations database to the archived database.	1	Demo
TDC-220.1	OR-TDCA-2	CapTOP shall be able to store aggregated speed, volume, and occupancy data from Traffic.Com stations in the CapTOP archived database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo

3.7.1.6 SpeedInfo Interface

3.7.1.6.1 Accessing the SpeedInfo Interface Subsystem

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-10	OR-DOC-1	CapTOP shall allow the TMC Operator to access the SpeedInfo interface subsystem, subject to operator privilege level.	C	Demo
SPD-10.1	OR-DOC-1	CapTOP shall allow the TMC Operator to access the SpeedInfo interface subsystem, using the following mechanisms: a. Left clicking on a SpeedInfo station icon on the map display; b. Left clicking on the SpeedInfo interface subsystem icon off the CapTOP toolbar; c. Left clicking on the SpeedInfo interface subsystem menu off the CapTOP toolbar.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-10.2	OR-SMM-5, OR-DOC-1	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. SpeedInfo station events and alarms; b. SpeedInfo station status (refer to SPD-40 and SPD-50); c. SpeedInfo station data (refer to SPD-40).	C	Demo
SPD-20	IR-GUI-10	CapTOP shall display all SpeedInfo station icons on a separate layer on the map-based display.	1	Demo
SPD-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the SpeedInfo station layer on the map display.	1	Demo
SPD-20.2	IR-GUI-10, IR-GUI-11	CapTOP shall allow a SpeedInfo station icon to be left clicked on the map display by the TMC Operator and permit access to the SpeedInfo station status window (refer to SPD-40 and SPD-50), with no more than 2 additional clicks.	1	Demo
SPD-20.3	IR-GUI-12	The icons used for the SpeedInfo station icon layer shall be unique from icons used in other layers.	1	Demo
SPD-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify SpeedInfo stations from the CapTOP map display (also refer to GUI-200*).	C	Demo
SPD-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new SpeedInfo station icon using a pop-up menu.	1	Demo
SPD-30.2	IR-GUI-10	When a SpeedInfo station icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	1	Demo
SPD-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each SpeedInfo station to enable the device to become operational in the system: a. Station Number; b. Detector ID; c. Description; d. Detector Model Number; e. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Intersection/Interchange. f. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); g. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); h. Group Name; i. Lane information: I. Number of Lanes; II. For each Lane: i. Direction; j. Model Number of Sensor;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		k. Protocol; l. Link ID; m. Polling Enabled (yes/no, defaults to yes); n. Associated CCTV; o. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
SPD-30.2.2	IR-GUI-10	When a SpeedInfo station device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with setting the device online or offline.	1	Demo
SPD-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo
SPD-30.3	IR-GUI-10, IR-GUI-11	CapTOP shall allow a SpeedInfo station icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. displaying the SpeedInfo station status window; e. allowing the device icon to be deleted.	1	Demo
SPD-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); h. Online-Offline Mode (online/offline); i. Protocol; j. Link ID; k. Polling Enabled (yes/no, defaults to yes); l. Associated CCTV.	1	Demo
SPD-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
SPD-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		selections for that field that begin with the 1st 3 characters typed by the user.		
SPD-30.4.3	OR-IM-4	CapTOP shall allow the user to select "Other" and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.1.6.2 Monitoring SpeedInfo Station Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-40	OR-DOC-10, IR-GUI-14, IR-GUI-16, OR-TDCA-1, UR-TO-25, OR-TDCA-11, OR-C2F-1	CapTOP shall allow the TMC Operator to retrieve and display the following operational status and operational data, on a real-time basis, for any SpeedInfo station, subject to operator privilege level: a. Station number; b. Detector ID; c. Road classification; d. Online-offline mode (static – set by System Administrator or Maintenance Technician); e. SpeedInfo server status (OK, failed); f. Detector status (OK, out-of-service); g. Average speed by direction per last aggregation interval; h. Last contact (date/time stamp on data); i. Last SpeedInfo server status change (date/time).	C	Demo
SPD-40.1	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the SpeedInfo server; b. data gained by CapTOP in attempts to communicate with the SpeedInfo server; c. online/offline information entered manually by authorized CapTOP users.	C	Demo
SPD-50	SR-SYS-2, IR-GUI-36, IR-GUI-26	CapTOP shall allow privileged users to simultaneously view SpeedInfo station status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display; b. Via the SpeedInfo station status window which lists all SpeedInfo stations, the station number, Detector ID, location, direction, online-offline mode, SpeedInfo server status, and Detector status.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method

SPD-50.1	IR-GUI-28,
	IR-GUI-26
		CapTOP shall use the following colors for device icon states:
		
		a. Black = out-of-service by SpeedInfo, but online in CapTOP;
		b. Orange = communication failure;
		c. Gray = offline.
		d. Maroon = online and speed is between 0% and 25% of free flow speed;
		e. Red = online and speed is between 25% and 50% of free flow speed;
		f. Yellow = online and speed is between 50% and 75% of free flow;
		g. Light Green = online and speed is between 75% and 90% of free flow speed;
		h. Dark Green = online and speed is > 90% of free flow speed.
		
		Also refer to GUI-150* requirements for an understanding of how traffic condition data is displayed on a per link basis.
			C	Demo

SPD-50.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: e. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; f. In order for the device icon to be red, maroon, yellow, light green, or dark green, the device must be both online and have OK communication.	C	Demo
SPD-50.2	IR-GUI-31, IR-GUI-29	The refresh rate for icon status and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
SPD-50.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to SPD-40 for the list of fields) by hovering over a SpeedInfo icon.	1	Demo
SPD-50.4	IR-GUI-29	CapTOP shall allow the user to select on any SpeedInfo station in the SpeedInfo status window (refer to SPD-50 item b) and view all details (full status, configuration information) pertaining to that SpeedInfo station.	1	Demo
SPD-60	SR-SYS-2, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a SpeedInfo station by the following methods: a. station number; b. detector ID; c. group name; d. street name; e. geographical address; f. intersection/interchange.	C	Demo
SPD-60.1	SR-SYS-2, IR-GUI-31	CapTOP shall allow the TMC Operator to search for SpeedInfo stations using a rubber-band style box on the map display to search an area.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-60.2	SR-SYS-2, IR-GUI-31	The result of each search shall be a list of SpeedInfo stations that are sorted, by default, by station number.	1	Demo
SPD-60.3	SR-SYS-2, IR-GUI-31, OR-TDCA-14	The result of each search shall be a list of SpeedInfo stations sortable by station number, detector ID, group name, street name, geographical address, and intersection/interchange.	1	Demo
SPD-70	IR-GUI-14, OR-TDCA-11	CapTOP shall provide a monitoring interface to SpeedInfo's existing remote server (in California) through CapTOP's new Traffic Data Server for monitoring the SpeedInfo stations. Refer to TDA-10* for more information.	C	Demo
SPD-70.1	OR-DOC-3, OR-TDCA-6	CapTOP's Traffic Data Server (developed by others, or optionally, by the CapTOP developer) shall interface with the SpeedInfo remote server in accordance with the SpeedInfo database schema and the SpeedInfo XML-based "listener" connection to access SpeedInfo station data.	1	Demo
SPD-70.1.1	OR-DOC-3, OR-TDCA-6	CapTOP shall obtain data in accordance with SpeedInfo's XML interface to access the following DDOT-relevant portions of the SpeedInfo database schema: a. Station number; b. Detector ID; c. Street name; d. Direction; e. Long/Lat; f. Speed; g. Date/time; h. Communication Status (OK, out-of-service).	1	Demo
SPD-70.1.2	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
SPD-70.1.2.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	The default polling interval shall be once every 5 minutes.	1	Demo
SPD-70.2	IR-GUI-14	CapTOP shall be able to request SpeedInfo station status and obtain status response data through the Traffic Data Server.	1	Demo
SPD-70.3	IR-GUI-14	CapTOP shall prohibit SpeedInfo detector changes through this interface.	1	Demo
SPD-80	OR-C2F-3, OR-C2F-4, OR-DWA-13. OR-TDCA-12	CapTOP shall be able to store all SpeedInfo station operational data (refer to SPD-40) in the CapTOP operations database for each polling cycle.	1	Demo
SPD-90	OR-TDCA-3	CapTOP shall store the station speed data by road name, interchange, direction, detector ID, and station number.	1	Demo

3.7.1.6.3 SpeedInfo Station Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-100	OR-TDCA-4, OR-TDCA-13	CapTOP shall be able to display and print data from SpeedInfo stations in both tabular and graphical formats.	2	Demo
SPD-110	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status and operational data of all SpeedInfo stations.	2	Demo
SPD-110.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the SpeedInfo station status summary report: a. Station number; b. Detector ID; c. Location; d. Road Direction; e. Number of lanes; f. Online-offline mode; g. Detector status (OK, out-of-service); h. SpeedInfo server status (OK, failed).	2	Demo
SPD-110.2	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the SpeedInfo station extended status report: a. Station number; b. Detector ID; c. Location; d. Road Direction; e. Road classification; f. Online-offline mode (static – set by System Administrator or Maintenance Technician); g. SpeedInfo server status (OK, failed); h. Detector status (OK, out-of-service); i. Number of lanes; j. Speed by direction per last aggregation interval; k. Last contact (date/time stamp on data); l. Last SpeedInfo server status change (date/time).	2	Demo
SPD-110.2.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format using data in the extended status report.	2	Demo
SPD-110.3	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to provide a full device configuration report for a user entered Station number or Detector ID.	2	Demo
SPD-120	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce the following performance reports for evaluating the performance of SpeedInfo stations, using data in the CapTOP operations and archived databases: a. Number of times a SpeedInfo station transitioned from online to offline over a specified time period; b. Number of times a SpeedInfo detector ID	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		status transitioned from OK to out-of-service over a specified time period; c. Number of times a SpeedInfo server status transitioned from OK to failed over a specified time period; d. A report showing missing data from each traffic detection station.		
SPD-130	OR-DWA-7, OW-DWA-5, OR-TDCA-13	CapTOP shall be able to produce a SpeedInfo station report by allowing the user to specify a station number, detector ID, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual).	2	Demo
SPD-140	OR-DWA-7, OW-DWA-5	CapTOP shall be able to produce the following reports by allowing the user to specify a station number, detector ID, starting date/time, ending date time, and a reporting interval (5 minute, 15 minute, hourly, daily, monthly, seasonal, quarterly, bi-annual, annual): a. Speed Peak Period Average; b. Speed Daily Average; c. Speed Weekly Average; d. Speed Monthly Average.	2	Demo
SPD-150	OR-DWA-7, OW-DWA-5	CapTOP shall allow the operator to search for data by specifying any of the following: a. Station number; b. Detector ID; c. Description; d. Location; e. Road Direction; f. Road classification; g. Group name; h. Starting date/time; i. Ending date/time; j. Type of data (speed); k. Number of lanes; l. Lane number; m. User specified speed; n. Reporting interval; o. Lane type (turning movement, non-turning movement).	2	Demo
SPD-160	OR-DWA-7, OW-DWA-5	CapTOP shall support an ad-hoc report generation capability that allows the user to build and specify their own queries based on data stored in SpeedInfo-related databases.	2	Demo
SPD-160.1	OR-TDCA-2	CapTOP shall be able to aggregate speed data on-the-fly from SpeedInfo stations in the CapTOP operations database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
SPD-160.2	OR-TDCA-2	CapTOP shall be able to store aggregated speed data from SpeedInfo stations in a Microsoft Excel format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
SPD-160.3	OR-TDCA-2	CapTOP shall be able to store aggregated speed data from SpeedInfo stations in a CSV (Comma Separated	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		Value) file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).		
SPD-160.4	OR-TDCA-2	CapTOP shall be able to store aggregated speed data from SpeedInfo stations in a text file format, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo
SPD-170	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format; c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	a. 2 b. 2 c. 2 d. 2 e. 2 f. 2	Demo

3.7.1.6.4 SpeedInfo Station Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-180	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to SpeedInfo stations and provide the output in a time sequential log.	C	Demo
SPD-180.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to SpeedInfo stations: a. any operator-initiated action resulting in a request to access information; b. when the user changes the SpeedInfo station configuration data; c. operator login; d. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-180.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to SpeedInfo stations: a. any system-initiated action that attempts to, or results in, a change to the CapTOP configuration data; b. when the SpeedInfo server status changes (OK to failed, and failed to OK); c. when detector ID status changes (OK to out-of-service, and out-of-service to OK); d. changes in online-offline mode; e. software application login; f. software application logout; g. database login; h. database logout. (Note: also refer to the LOG-* requirements).	1	Demo
SPD-180.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for SpeedInfo stations.	1	Demo
SPD-180.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all SpeedInfo station activities: a. operator input; b. operator informational message; c. operator error; d. system warning; e. system error; f. system information message; g. software application warning; h. software application error; i. software application information message.	1	Demo
SPD-180.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the device ID, description of action, and summary status of device).	1	Demo
SPD-180.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
SPD-180.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-190	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to SpeedInfo stations from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.	1	Demo
SPD-200	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in SpeedInfo server status (OK to failed, and failed to OK); b. changes in online-offline mode; c. changes to SpeedInfo station configuration data; d. when a detector ID status changes to out-of-service.	1	Demo

3.7.1.6.5 SpeedInfo Station Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SPD-210	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to SpeedInfo stations from the log database to the archived database.	1	Demo
SPD-220	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to SpeedInfo stations from the operations database to the archived database.	1	Demo
SPD-220.1	OR-TDCA-2	CapTOP shall be able to store aggregated speed data from SpeedInfo stations in the CapTOP archived database, at a user specified interval, between 1 minute and 525,600 minutes (1 year).	1	Demo

3.7.1.7 CIPS Interface

CapTOP's CIPS interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-70;
- SYS-80*;
- SYS-100.1;
- GUI-260*;
- INM-100;
- INM-100.1.

In addition, CapTOP shall meet the requirement below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CIP-10	UR-TO-15	CapTOP shall be able to receive and display CIPS detection notifications and provide the TMC Operator with access to CIPS live and playback video.	1	Demo
CIP-20	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	Demo
CIP-30	OR-CIP-2	CapTOP shall be able to receive CIP alerts in the form of data and video.	1	Demo
CIP-40	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	Demo
CIP-50	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	Demo

3.7.1.8 ROP AVL Tracking Interface

CapTOP's ROP AVL tracking interface requirements are addressed in various sections. Refer to the following requirements:

- GUI-120.1.1;
- GUI-130;
- CCT-360;
- INM-100;
- INM-110;
- INM-360.3;
- INM-490*;
- INM-500;
- INM-510.

3.7.2 Traffic Control and Traveler Information Requirements

This section describes the functional requirements needed to perform traffic control and to disseminate traveler information.

3.7.2.1 DMS and PDMS Requirements

3.7.2.1.1 Accessing the DMS/PDMS System

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-10	OR-DOC-15	CapTOP shall allow the TMC Operator to access the DMS/PDMS subsystem, subject to operator privilege level.	C	Demo
DMS-10.1	OR-DOC-1	CapTOP shall allow the TMC Operator to access the	1	Demo

		DMS/PDMS subsystem, using the following mechanisms: a. Left clicking on a DMS/PDMS icon on the map display; b. Left clicking on the DMS/PDMS subsystem icon off the CapTOP toolbar; c. Left clicking on the DMS/PDMS subsystem menu off the CapTOP toolbar.		
DMS-10.2	OR-SMM-5, OR-DOC-17	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. DMS/PDMS events and alarm logs; b. DMS/PDMS message transmission; c. DMS/PDMS message creation; d. Editing of DMS/PDMS message schedule; e. DMS/PDMS status (refer to DMS-40); f. Override control if a DMS/PDMS is locked (if implemented); g. DMS/PDMS maintenance/diagnostic commands (refer to DMS-150).	C	Demo
DMS-20	IR-GUI-10	CapTOP shall display all DMS/PDMS icons on a separate layer on the map-based display.	1	Demo
DMS-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the DMS/PDMS layer on the map display.	1	Demo
DMS-20.2	IR-GUI-10, OR-DOC-16, OR-TID-2	CapTOP shall allow the TMC Operator to left click a DMS/PDMS icon and perform the following with no more than 2 additional clicks: a. View the current message; b. Blank the sign; c. Invoke the DMS/PDMS control window (refer to DMS-140); d. View the DMS/PDMS status window (refer to DMS-50); e. View the sign characteristics (size, type, location, communication status).	1	Demo
DMS-20.3	IR-GUI-12	The icons used for the DMS/PDMS icon layer shall be unique from icons used in other layers.	1	Demo
DMS-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify DMS/PDMS devices from the CapTOP map display (also refer to GUI-200*).	C	Demo
DMS-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new DMS/PDMS icon using a pop-up menu.	1	Demo
DMS-30.2	IR-GUI-10	When a DMS/PDMS device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with a window to enter all configuration data required to integrate the device.	1	Demo
DMS-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be created and modified for each DMS/PDMS device to enable the device to become operational in the system: a. Controller ID; b. Group Name (as applicable); c. Description;	1	Demo

		d. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Closest Intersection/Interchange. e. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); f. Communication Type (dialup serial, network serial, IP); g. Multidrop Information; I. Drop Address; II. Channel ID; III. Port Name. h. IP Information; I. IP Address; II. Port Number. i. Dialup Information; I. Dialup Number. j. Serial Information; I. Baud Rate; II. No. Data Bits; III. Parity; IV. No. Stop Bits; V. H/W Flow Control; VI. S/W Flow Control. k. NTCIP Community; l. Firmware Version; m. Cabinet Number; n. Controller Model Number; o. Protocol; p. Link ID; q. Type (based on size/geometry); r. Sign Type (full matrix, character based); s. Display Size; t. Character Size; u. Polling Enabled (yes/no, defaults to yes); v. Comm Loss Timeout (seconds in .1 increments); w. Power Loss Timeout (seconds in .1 increments); x. Associated HAR; y. Associated CCTV; z. Control Mode (central, local, central override); aa. Default Intensity;		

		bb. Automatic Intensity Enabled; cc. Controller Date/Time/Time Zone/Daylight Savings Time Setting; dd. Controller Time Synchronization Source; ee. Temperature Thresholds and Alarm settings for Sign Housing (critical minimum, critical maximum, warning minimum, warning maximum); ff. Ventilation Thresholds and Alarm Settings for Sign Housing (critical minimum, critical maximum, warning minimum, warning maximum); gg. Temperature Thresholds and Alarm Settings for Cabinet (critical minimum, critical maximum, warning minimum, warning maximum); hh. Ambient Temperature Thresholds and Alarm Settings (critical minimum, critical maximum, warning minimum, warning maximum); ii. Set Point Temperature to Turn Heater On; jj. Set Point Temperature to Enable Ventilation System; kk. Pixel Cycle Time Frequency and Base Time; ll. Default Message Setting; mm. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
DMS-30.2.2	IR-GUI-10	When a DMS/PDMS device icon is added, CapTOP shall prompt the System Administrator with setting the device online or offline.	1	Demo
DMS-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo
DMS-30.3	IR-GUI-10	CapTOP shall allow a DMS/PDMS device icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. allowing the device icon and associated	1	Demo

		configuration information to be deleted.		
DMS-30.4	IR-GUI-10	CapTOP shall automatically adjust the location of all PDMS icons on the map display based on the real-time GPS location (x/y or lat/long coordinates) that is available from the status poll to each DMS.	1	Demo
DMS-30.4.1	OR-DDM-24	CapTOP shall be able to remotely locate and record portable DMS locations via GPS.	1	Demo
DMS-30.5	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Online-Offline Mode (online/offline); h. Communication Type (dialup serial, network serial, IP); i. Protocol; j. Link ID; k. Polling Enabled (yes/no, defaults to yes); l. Associated CCTV; m. Associated HAR; n. Control Mode (central, local, central override); o. Type (based on size/geometry); p. Sign Type (full matrix, character based); q. Display Size; r. Character Size.	1, item m priority 2	Demo
DMS-30.5.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
DMS-30.5.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
DMS-30.5.3	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.2.1.2 Monitoring DMS/PDMS Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-40	OR-DOC-1, OR-DOC-15, IR-GUI-16	CapTOP shall allow the TMC Operator to retrieve and display the following operational status for any DMS/PDMS, subject to operator privilege level a. Controller ID; b. Online-offline mode (static – set by System Administrator or Maintenance Technician); c. Communication status (OK, failed); d. Controller status (OK, failed); e. Control mode (central, local, central override);	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		f. Lock status (username if locked, if implemented); g. Current message; h. Last contact (date/time); i. Last communication status change (date/time); j. Alarm status.		
DMS-40.1	OR-DOC-1, OR-DOC-15	CapTOP subject to operator privilege level or related 3rd party software shall allow the TMC Technician to obtain the following operational status and operational data for any DMS/PDMS,: a. Online-offline mode (static – set by System Administrator or Maintenance Technician); b. Communication status (OK, failed); c. Control mode (central, local, central override); d. Lock status (username if locked, if implemented); e. Power errors; f. Lamp errors; g. Pixel errors; h. Light sensor errors; i. Last error; j. Climate control errors; k. Current message; l. Photocell level; m. Intensity/Brightness level; n. Automatic intensity enabled; o. Sign housing temperature; p. Sign housing humidity; q. Sign controller cabinet temperature; r. Sign controller cabinet humidity; s. Controller date/time/time zone/daylight savings time setting; t. Controller time synchronization source; u. Heater thresholds and alarms for cabinet housing and cabinet; v. Ventilation thresholds and alarms; w. Pixel cycle time frequency; x. Default message setting; y. Last contact (date/time); z. Last communication status change (date/time); aa. Alarm status.	1	Demo
DMS-40.1.1	OR-DOC-1 OR-DOC-15	CapTOP shall be able to report for current message both the message commanded to be displayed by the DMS controller and a pixel-by-pixel mapping of the illuminated pixels in real time based on measurement made by the sign electronics.	C	Demo
DMS-40.2	OR-DOC-1, OR-DOC-15	CapTOP subject to operator privilege level or related 3rd party software shall allow the TMC Technician to obtain the list of fonts loaded in the DMS/PDMS.	1	Demo
DMS-40.3	OR-DOC-1	CapTOP subject to operator privilege level or related 3rd party software shall provide the same status	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		information for PDMS as DMS, and also include the following: a. Battery voltage; b. Line voltage; c. GPS location; d. Engine RPM level; e. Fuel level; f. Speed from radar detector (as applicable).		
DMS-40.4	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the DMS/PDMS; b. data gained by CapTOP in attempts to communicate with the DMS/PDMS; c. online/offline information entered manually by authorized CapTOP users.	C	Demo
DMS-50	SR-SYS-2, IR-GUI-29, IR-GUI-36, IR-GUI-26	CapTOP shall allow users to simultaneously view DMS/PDMS status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display; b. Via the DMS/PDMS status window which lists all DMSs/PDMSs, the Controller ID, location, online-offline mode, communication status, and controller status.	C	Demo

DMS-50.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following colors for device icon states:
		a. Green = online;
		b. Green with Yellow in middle = online and message display;
		c. Black with Yellow in middle = online, locked, and message display (if locking implemented);
		d. Red = device failure;
		e. Yellow = communication failure;
		f. Gray = offline;
		g. Brown = partial operation or recent failure.
			C	Demo

DMS-50.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: a. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; b. In order for the device icon to be green, the device must be both online and have OK communication.	C	Demo
DMS-50.2	IR-GUI-29	The refresh rate for the status of the icons and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
DMS-50.3	IR-GUI-30	To distinguish PDMS icons from DMS icons, CapTOP shall display a yellow antenna on the icons associated with PDMSs.	1	Demo
DMS-50.4	IR-GUI-30	CapTOP shall automatically refresh PDMS device locations on the map-display in a configurable time interval.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-50.5	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to DMS-40 for the list of fields) by hovering over a DMS/PDMS icon.	1	Demo
DMS-50.6	IR-GUI-29	CapTOP shall allow the user to select on any DMS/PDMS in the DMS/PDMS status window (refer to DMS-50 item b) and view all details (full status, configuration information, and DMS/PDMS controls) pertaining to that DMS/PDMS.	1	Demo
DMS-60	SR-SYS-2, IR-GUI-29, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a DMS by the following methods: a. by device ID; b. by IP address/drop address/channel ID/phone number; c. by street name; d. by geographical address; e. by intersection/interchange.	1	Demo
DMS-60.1	SR-SYS-2, IR-GUI-29	CapTOP shall allow the TMC Operator to search for DMSs/PDMSs using a rubber-band style box on the map display to search an area.	1	Demo
DMS-60.2	SR-SYS-2, IR-GUI-29	The result of each search shall be a list of DMSs/PDMSs that are sorted, by default, by device ID.	1	Demo
DMS-60.3	SR-SYS-2, IR-GUI-29	The result of each search shall be a list of DMSs/PDMSs sortable by device ID, IP address/drop address/channel ID/phone number, street name, geographical address, and intersection/interchange.	1	Demo
DMS-70	IR-GUI-13	CapTOP shall provide a monitoring and control interface through communication servers for managing all DMS/PDMS.	C	Demo
DMS-70.1	OR-DOC-11, SR-SYS-8, SR-SYS-23	CapTOP shall provide a monitor and control interface to all DMSs/PDMSs using the latest DMS/PDMS NTCIP 1203 standard, if supported by the DMS/PDMS; otherwise, CapTOP shall conform to the existing DMS/PDMS's supported protocol.	C	Demo
DMS-70.1.1	OR-DOC-11, SR-SYS-8, SR-SYS-23	CapTOP shall communicate using NTCIP to the following DMSs/PDMSs: a. MARK IV FP9000; b. VER-MAC 3048SCEN2008; c. VER-MAC 3056SCEN2007.	C	Demo
DMS-70.1.2	OR-DOC-11, SR-SYS-8, SR-SYS-23	For DMS/PDMS that do not support the NTCIP protocol, CapTOP shall implement data communications using native protocols for the following controllers: a. PSC SMC2000HE; b. PSC SME200FM; c. FDS Controllers; d. Addco Controllers.	C	Demo
DMS-70.2	IR-GUI-13	CapTOP shall be able to request DMS/PDMS status and obtain status response data through the monitoring and control interface including all data items noted in DMS-40.1 and DMS-40.3.	C	Demo
DMS-70.2.1	OR-DOC-2, OR-DOC-3,	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	IR-GUI-29			
DMS-70.3	IR-GUI-13	CapTOP shall be able to issue control commands and receive status response through the monitoring and control interface.	C	Demo
DMS-70.4	IR-GUI-17	CapTOP shall be capable of communicating to DMS/PDMS devices using the following physical communication media: a. regular telephone lines; b. wireless connections (CDMA/GPRS and other modems); c. network connections.	C	Demo
DMS-80	UR-TO-25	CapTOP shall provide the TMC Operator and the Maintenance Technician using CapTOP or related 3rd party software as appropriate the ability to monitor the status of the following: a. DMS device status (refer to DMS-40); b. DMS events and alarm logs; c. DMS/PDMS online-offline mode; d. Control mode (central, local, central override); e. Communication status (OK, failed).	C	Demo
DMS-90	OR-C2F-2, OR-DWA-13	CapTOP shall be able to store DMS/PDMS operational status (refer to DMS-40) and operational data captured by CapTOP (refer to DMS-40.1) in the CapTOP operations database.	C	Demo
DMS-90.1	OR-C2F-2, OR-DWA-13	CapTOP shall be able to store DMS/PDMS equipment status on state transitions.	1	Demo
DMS-100	OR-TDCA-20	CapTOP or related third party software shall be able to, at the System Administrator's or Maintenance Technician's request, upload and display all configuration data available from the DMS/PDMS field controller/receiver.	1	Demo
DMS-110	OR-TDCA-21	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and store all configuration data managed by CapTOP in the CapTOP central system device configuration database for DMS/PDMS.	1	Demo
DMS-120	OR-TDCA-22	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, download all configuration data managed by CapTOP from the CapTOP central system device configuration database to the DMS/PDMS field controller/receiver.	1	Demo

3.7.2.1.3 DMS/PDMS Control Commands

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-130	OR-DOC-21	CapTOP shall allow the TMC Operator to select a DMS/PDMS and view a list of the defined messages for each DMS/PDMS through the CapTOP GUI.	C	Demo
DMS-130.1	OR-DOC-21	CapTOP shall provide the TMC Operator the ability to select DMS/PDMS messages from the central system's library of messages, subject to privilege level, based on	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		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.		
DMS-130.2	OR-DOC-21	CapTOP shall provide the TMC Operator the ability to enter a free-form message to send to a DMS/PDMS.	C	Demo
DMS-140	OR-DOC-21	CapTOP shall require supervisor approval of all free-form messages prior to transmission by the Operator.	C	Demo
DMS-150	OR-DOC-17, SR-SYS-23, OR-TID-4	CapTOP shall allow the TMC Operator to issue the following commands to any DMS/PDMS, using an intuitive GUI control window, subject to operator privilege level: a. display message; b. blank message; c. display date/time; d. display travel time message (destination, distance, travel time range); e. edit DMS/PDMS message schedule; f. display diagnostic message.	C	Demo
DMS-160	OR-DOC-17, SR-SYS-23	CapTOP subject to operator privilege level or related 3rd party software shall allow the System Administrator or Maintenance Technician to issue the following commands to any DMS/PDMS, using an intuitive GUI control window: a. display message; b. blank message; c. display date/time; d. set controller date/time/time zone/time synchronization source; e. display pixel test; f. display pixel pattern; g. test RAM; h. test sign driver; i. cut network power; j. restore network power; k. display all status and configuration information (refer to DMS-40.1*); l. modify configuration information (refer to DMS-30.2*); m. edit and delete messages; n. delete volatile messages; o. edit DMS/PDMS message schedule; p. set control mode (central, local, central override); q. set online-offline mode; r. reset controller.	C	Demo
DMS-160.1	OR-DOC-17, SR-SYS-23	CapTOP shall allow the TMC Operator to specify a value for an optional parameter called “maximum message duration”, represented in seconds from 0-9,999,999.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-170	OR-DOC-22	CapTOP shall allow the TMC Operator to transmit a message to a DMS and PDMS manually and according to a schedule, subject to operator privilege level.	C	Demo
DMS-180	SR-SYS-2	CapTOP shall allow two or more different users to simultaneously control two or more different DMSs/PDMSs at the same time.	C	Demo
DMS-190	SR-SYS-2, IR-GUI-19	CapTOP shall allow users, with proper privileges, to monitor and control any DMS/PDMS, from any CapTOP workstation.	C	Demo
DMS-200	SR-SYS-2, OR-SMM-5	CapTOP shall provide a software locking mechanism to prevent 2 or more operators from simultaneously controlling the same DMS/PDMS.	3	Demo
DMS-200.1	SR-SYS-2, OR-SMM-5	If the DMS/PDMS is locked, CapTOP shall allow all TMC operators, subject to privilege level, to only view the status and current message of a DMS/PDMS (not control).	3	Demo
DMS-200.2	SR-SYS-2, OR-SMM-5	CapTOP shall provide a notification to the user when he attempts to control a DMS/PDMS currently locked by another user.	3	Demo
DMS-200.2.1	SR-SYS-2, OR-SMM-5	The notification shall provide the ID of the DMS/PDMS and the user name that has the DMS/PDMS locked.	3	Demo
DMS-200.3	OR-SMM-5	CapTOP shall allow a DMS icon to be left clicked on the map display by the TMC Operator, subject to privilege level, and enable locking with no more than 2 clicks.	3	Demo
DMS-200.4	OR-SMM-5	CapTOP shall remove DMS locks set by an individual user when that user logs out of the system	3	Demo
DMS-200.5	OR-SMM-5	CapTOP shall remove DMS locks after a configurable time period has elapsed.	3	Demo
DMS-210	SR-SYS-2, OR-SMM-5	CapTOP shall provide the ability for a user with override privileges to unlock DMSs/PDMSs that are locked.	3	Demo
DMS-210.1	OR-SMM-5	CapTOP shall issue an alert to a user when a DMS that the user locked has been overridden.	3	Demo

3.7.2.1.4 DMS/PDMS Message Scheduler

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-220	OR-DOC-22, OR-DOC-30	CapTOP shall be able to define and schedule DMS/PDMS messages to be displayed automatically using a schedule editor.	C	Demo
DMS-220.1	OR-DOC-22, OR-DOC-30	The CapTOP schedule capability shall permit time of day recurring and non-recurring entries for DMS/PDMS messages.	C	Demo
DMS-220.2	OR-DOC-22, OR-DOC-30	The schedule shall permit a non-recurring, one-time only message to be transmitted to a DMS/PDMS, where the user specifies a schedule name, DMS/PDMS ID, message ID, reminder date/time, start date/time and end date/time.	C	Demo
DMS-220.3	OR-DOC-22, OR-DOC-30	The schedule shall permit a non-recurring, one-time only message to be transmitted to a DMS/PDMS	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		group, where the user specifies a schedule name, group ID, message ID, reminder date/time, start date/time and end date/time.		
DMS-220.4	OR-DOC-22, OR-DOC-30	CapTOP shall provide a recurring schedule capability and permit any of the following recurring entry types: a. Weekdays – Monday through Friday; b. Weekends – Saturday and Sunday only; c. All Days – Monday through Sunday; d. One day or any combination of days per week; e. One day or any combination of days per month.	C	Demo
DMS-220.4.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow recurring schedule entries to be created for a DMS/PDMS, where the user specifies a schedule name, DMS/PDMS ID, recurring entry type, message ID, reminder date/time, start date/time and end date/time (optional).	C	Demo
DMS-220.4.2	OR-DOC-22, OR-DOC-30	CapTOP shall allow recurring schedule entries to be created for a DMS/PDMS group, where the user specifies a schedule name, group ID, recurring entry type, message ID, start date/time and end date/time (optional).	1	Demo
DMS-220.4.3	OR-DOC-22, OR-DOC-30	CapTOP shall permit an optional end date to be specified for all recurring schedule entries.	1	Demo
DMS-220.4.3.1	OR-DOC-22, OR-DOC-30	CapTOP shall implement the recurring scheduling indefinitely if no end date is specified.	1	Demo
DMS-220.4.4	OR-DOC-22, OR-DOC-30	CapTOP shall allow a Holiday schedule to be specified for the CapTOP system.	1	Demo
DMS-220.4.4.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to indicate whether each Holiday is treated as an exception to the recurring schedule.	1	Demo
DMS-220.4.4.2	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to specify each Holiday exception to be treated as either a Weekend or Weekday whenever encountered.	1	Demo
DMS-230	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to edit and delete scheduled entries for DMSs/PDMSs.	1	Demo

3.7.2.1.5 DMS/PDMS Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-240	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to produce a report of all scheduled entries for an individual DMS/PDMS or all DMSs/PDMSs.	2	
DMS-240.1	OR-DOC-22, OR-DOC-30	The report shall list all schedule entries, and shall contain the following: a. Schedule name; b. DMS/PDMS or Group ID; c. Message ID; d. Recurrent entry type (optional); e. State Date/Time; f. End Date/Time (optional).	2	
DMS-250	SR-SYS-22,	CapTOP shall be able to automatically generate real-	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	SR-SYS-36, OR-DOC-4, IR-GUI-8	time tabular reports that show the real-time operational status and operational data of all DMSs/PDMSs.		
DMS-250.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the DMS/PDMS status report: a. DMS/PDMS ID; b. Location; c. Online-offline mode; d. Locked or unlocked status with user name (if implemented); e. Communication status (OK, failed); f. Control mode (central, local, central override); g. Alarm status; h. Message ID being displayed.	2	Demo
DMS-260	OR-DWA-7	CapTOP shall be able to produce the following performance reports for evaluating the performance of DMSs/PDMSs, using data in the CapTOP operations and archived databases: a. Number of times a DMS/PDMS transitioned from online to offline over a specified time period; b. Number of times a DMS/PDMS transitioned from no device failure to device failure over a specified time period; c. Number of times a DMS/PDMS transitioned from no communication failure to communication failure over a specified time period.	2	Demo
DMS-270	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8, UR-TO-11, OR-TID-3	CapTOP shall be able to display and print the following reports: a. For a user entered DMS ID, provide a message history report, consisting of the DMS ID, message ID, date/time transmitted, and username who transmitted the message. b. For a user entered user ID, provide a message history report, consisting of the User ID, DMS ID, message ID, and date/time transmitted. c. For a user entered CCTV ID, provide a full device configuration report; d. For a user specified time-interval, provide a DMS message history report, consisting of the DMS ID, message ID, date/time transmitted, and username who transmitted the message; e. An ad-hoc report where the user can query any data stored in DMS related databases.	2	Demo
DMS-270.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format.	a. 2 b. 2 c. 2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	d. 2 e. 2 f. 2	

3.7.2.1.6 DMS/PDMS Message Editor

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-280	OR-DOC-18, OR-DOC-19, OR-DOC-20, OR-DOC-32	The CapTOP software shall provide a DMS message editor that supports the following: a. allows the TMC Operator to create a single-phase message; b. allows the TMC Operator to create a multiple-phase message and specify the time between phases in 1/10th second increments from 1.0 - 25.5, with a default of 2.0 seconds; c. allows the TMC Operator to select a message from the central system's library; d. allows the TMC Operator to edit a typed message; e. allows the TMC Operator to edit any field of a message from the library; f. allows the TMC Operator to save the new message in the library or replace an existing message in the library; I. requires Supervisor approval to save the message. II. requires the TMC Operator to provide a unique message ID for the saved message; g. requires the TMC Operator to assign a message priority to each message; h. provides the ability to identify and store the type of signs that support the message; i. allows the TMC Operator to view a simulation of the message to scale on a pixel-by-pixel basis with regard to how the message will actually appear on each sign type based on the sign dimensions and mode (full-matrix or character based).	C	Demo
DMS-290	OR-DOC-18, OR-DOC-19, OR-DOC-20, OR-TID-4	CapTOP shall support the following message features in the message editor: a. message formats using the Mark-Up Language for Transportation Information (MULTI) DMS mark-up language as specified in the NTCIP document 1203 version 2;	All priority 1 except item g is priority 3	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		b. left, right, or centered justification on a per line basis; c. creation of messages in full-matrix or character-based mode; d. support for different font-types per message (multiple types per message); e. support for different font-sizes per message (multiple sizes per message); f. the ability to specify the number of pixels between lines (line spacing); g. the ability to specify the number of pixels between characters (character spacing); h. selection of graphics in .bmp format for full-matrix signs; i. selection of colors for full-matrix signs; j. the ability to flash words in the message; k. the ability to flash lines in the message; l. the ability to flash the entire message; m. the ability to specify a flash rate as a number 0.0 to 25.5 in .1 second increments; n. the ability to bold words in the message; o. the ability to reverse the pixels for a word; p. the ability to reverse the pixels for a line; q. the ability to reverse the pixels for a message; r. the ability to insert the current time into any message using any of the following of formats: hh:mm AM/PM or hh:mm or hh:mm:ss AM/PM or hh:mm:ss; s. the ability to insert the current date into any message using any of the following formats: mm/dd/yy or mmm dd, yyyy; t. the ability to insert the current outside ambient temperature into any message (if applicable). u. the ability to insert special characters into the message (as defined by the manufacturer); v. the ability to insert the current speed, as measured by radar detectors (if built into the DMS/PDMS), into the message; w. the ability to insert a one-destination, one-line, two-line or three-line travel time message consisting of destination, distance and travel time range; x. the ability to insert a two-line, two-destination travel time message with each line consisting of destination, distance and travel time range; y. the ability to insert a three-line, three-destination travel time message with each line consisting of destination, distance and travel time range; z. notification to the TMC Operator if the message is too big to be displayed;		
DMS-300	OR-DOC-18, OR-DOC-19,	CapTOP shall spell check all created messages and messages stored in the central system's library, and	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-DOC-20	prohibit the use of misspelled and restricted words in any message.		
DMS-300.1	OR-DOC-18, OR-DOC-19, OR-DOC-20	CapTOP shall provide a configurable list of prohibited restricted words editable only by the System Administrator.	1	Demo
DMS-300.2	OR-DOC-18, OR-DOC-19, OR-DOC-20	CapTOP shall use a dictionary to ensure all words are spelled correctly.	1	Demo
DMS-300.3	OR-DOC-18, OR-DOC-19, OR-DOC-20	CapTOP shall allow the System Administrator to add, change and remove words from the dictionary.	1	Demo
DMS-300.4	OR-DOC-18, OR-DOC-19, OR-DOC-20	CapTOP shall provide an error message listing any words that do not pass the spell check or restricted word check.	1	Demo
DMS-300.4.1	OR-DOC-18, OR-DOC-19, OR-DOC-20	CapTOP shall prevent the message from being transmitted and saved until the errors are corrected or the message is approved by the TMC Manager.	1	Demo
DMS-310	OR-DOC-21	The CapTOP DMS message library in the central system shall have the following capabilities: a. be capable of storing a minimum of 5,000 messages; b. be capable of having a name associated with the library; c. support multiple libraries; d. be capable of creating, deleting and editing libraries and messages within the library, in accordance with user privileges; e. be capable of storing messages that are sign-specific using a message attribute to denote the message type; f. be capable of searching for messages in the library using a keyword or phrase; g. be capable of storing messages applicable to multiple sign types that can fit the message using a message attribute to denote the message type; h. be capable of storing the messages in text format; i. allow the TMC Operator to delete messages, one at a time, in accordance with user privileges; j. allow the TMC Operator to delete all messages in one command in accordance with user privileges; k. allow the TMC Operator to select multiple messages and delete them in one command, in accordance with user privileges.	C	Demo
DMS-320	OR-DOC-21	CapTOP shall allow the same message to be sent to multiple DMSs of the same type using a drag and drop capability, in accordance with user privileges.	1	Demo
DMS-330	OR-DOC-21	CapTOP shall allow the same message to be sent to multiple DMSs of the same type using a multiple selection capability, in accordance with user privileges.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-340	OR-DOC-21	CapTOP shall allow the same message to be sent to all DMSs in the same group, in accordance with user privileges.	1	Demo
DMS-350	OR-DOC-21	CapTOP shall allow, in accordance with user privileges, the same message to be sent to multiple DMSs of different sizes, provided the message is able to fit on the sign.	1	Demo
DMS-350.1	OR-DOC-21	CapTOP shall abbreviate words automatically for messages that don't fit on a particular sign, to determine if the message will fit for a particular type.	1	Demo
DMS-350.2	OR-DOC-21	CapTOP shall use a configurable list of abbreviations, editable only by the System Administrator.	1	Demo
DMS-350.3	OR-DOC-21	CapTOP shall notify the user in the event a message is attempted to be transmitted to a sign that is too small to display the message.	1	Demo
DMS-350.4	OR-DOC-21	CapTOP shall prevent truncated messages from being transmitted to signs.	1	Demo
DMS-350.5	OR-DOC-21	After a message has been truncated or abbreviations inserted into a message, CapTOP will prompt a TMC Operator currently active on the system for acceptability of the revised message prior to display, only displaying the message if the TMC Operator accepts the revision.	1	Demo
DMS-360	OR-DOC-31	CapTOP shall notify the TMC Operator of any failed message transmissions.	1	Demo
DMS-370	OR-DOC-31, SR-SYS-24, IR-GUI-29	CapTOP shall take no longer than 60 seconds after initiation of message transmission to update the message on the sign and receive confirmation the message was posted via the communication protocol.	1	Demo
DMS-380	OR-DOC-21	CapTOP shall take no longer than 40 seconds after receipt of confirmation of message posting or failure to update the status of the DMS within the system.	1	Demo
DMS-390	OR-DOC-21	CapTOP shall provide a parameter that specifies the maximum number of phases per DMS.	1	Demo
DMS-400	OR-DOC-21	CapTOP shall be able to manage a DMS inventory of 5,000 signs.	1	Demo
DMS-410	OR-DOC-21, SR-SYS-2	CapTOP shall manage messages coming from multiple operators and the system scheduler, and shall prioritize all of these into a single list and shall post the message with the highest priority.	1	Demo
DMS-410.1	OR-DOC-21, SR-SYS-2	CapTOP shall have the ability to notify the TMC Operator, TMC Manager, and Maintenance Manager when there is a conflict with two or more messages, of the same priority, attempting to be sent out at the same time or within 5 minutes of one another.	1	Demo
DMS-410.2	OR-DOC-21, SR-SYS-2	CapTOP shall display an error message whenever a lower priority message is attempted to be transmitted while a higher priority message is displayed.	1	Demo
DMS-420	OR-DOC-21	CapTOP shall allow the TMC Operator, subject to privilege level, to be able to create, delete, and edit DMS groups.	1	Demo
DMS-420.1	OR-DOC-21	CapTOP shall provide the following fields in the definition of each group:	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		a. Group name; b. List of DMSs having membership in the group.		
DMS-420.2	OR-DOC-21	CapTOP shall allow each DMS to have membership in 1 or more DMS groups.	1	Demo
DMS-420.3	OR-DOC-21	CapTOP shall ensure that each DMS in the group is of the same type and of the same size.	1	Demo

3.7.2.1.7 Font Editor

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-430	OR-DOC-19	CapTOP shall provide a DMS/PDMS font editor that provides the ability to create, modify, and delete fonts.	1	Demo
DMS-430.1	OR-DOC-19	The TMC Operator, with appropriate privilege, shall be able to define a font with the following characteristics: a. Font name; b. Font height; c. Space between characters; d. Space between lines; e. List of characters, and for each provide: I. ASCII code; II. Character symbol letter; III. Character symbol represented as bitmap matrix; IV. Width.	1	Demo
DMS-430.2	OR-DOC-19	The font editor shall provide a bitmap-type editor, based on the height and width of the character set, that allows pixels to be turned on/off to create each character.	1	Demo
DMS-430.3	OR-DOC-19	The font editor shall provide the ability to clear the editing screen, reverse pixel settings for the character, and zoom in and out on the display.	1	Demo
DMS-430.4	OR-DOC-19	The font editor shall provide a display that lists all the characters in the font and provide a display that represents how each character will appear on the DMS/PDMS.	1	Demo
DMS-430.5	OR-DOC-19	The font editor shall provide a display that lists all the available fonts.	1	Demo
DMS-430.6	OR-DOC-19	The font editor shall provide a report that allows the TMC Operator to print all the characters in the font, with their ASCII code, and width displayed.	2	Demo
DMS-430.6.1	OR-DOC-19	The report shall also indicate the font name, font height, space between characters, and space between lines.	2	Demo

3.7.2.1.8 Graphics Editor

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-440	OR-DOC-19	CapTOP shall provide a DMS/PDMS graphics editor that provides the ability to create, modify, and delete	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		graphics.		
DMS-440.1	OR-DOC-19	The TMC Operator, with appropriate privilege, shall be able to define a graphic with the following characteristics: a. graphic name; b. graphic height; c. graphic width; d. graphic represented as a bitmap matrix.	1	Demo
DMS-440.2	OR-DOC-19	The graphics editor shall provide a bitmap-type editor, sized for the height and width of the graphic, that allows pixels to be turned on/off to create each graphic.	1	Demo
DMS-440.3	OR-DOC-19	The graphics editor shall provide the ability to import bitmaps into the editor.	1	Demo
DMS-440.4	OR-DOC-19	The graphics editor shall provide the ability to clear the editing screen, reverse pixel settings for the image, and zoom in and out on the display.	1	Demo
DMS-440.5	OR-DOC-19	The graphics editor shall provide a display that lists all the graphics that are available in the system.	1	Demo
DMS-440.5.1	OR-DOC-19	The graphics editor shall provide a simulation display of the graphic as it will appear on the DMS/PDMS.	1	Demo
DMS-440.6	OR-DOC-19	The graphics editor shall provide a report that allows the TMC Operator to print each graphic.	1	Demo
DMS-440.6.1	OR-DOC-19	The report shall also indicate the graphic name, graphic height, and graphic.	1	Demo

3.7.2.1.9 DMS/PDMS Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-450	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to DMSs/PDMSs and provide the output in a time sequential log.	C	Demo
DMS-450.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to DMSs/PDMSs: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to a DMS/PDMS; c. changes to the message library (new messages, changes to existing messages; deleted messages); d. message transmission to a DMS/PDMS; e. when the user changes the DMS/PDMS configuration data; f. results from operator-initiated sign diagnostic and sign status requests g. operator login; h. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo
DMS-450.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		pertain to DMSs/PDMSs: a. any system-initiated action that attempts to, or results in, a change to the device; b. when the communication status changes (OK to failed, and failed to OK); c. changes in online-offline mode; d. changes in control mode (central, local, central override); e. results from system-initiated sign diagnostic and sign status requests; f. software application login; g. software application logout; h. database login; i. database logout. (Note: also refer to the LOG-* requirements).		
DMS-450.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for DMSs/PDMSs.	1	Demo
DMS-450.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all DMS/PDMS activities: a. operator input; b. operator command transmission; c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.	1	Demo
DMS-450.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (for message updates, include the device ID, message ID and summary status of DMS/PDMS prior to transmission).	1	Demo
DMS-450.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
DMS-450.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo
DMS-460	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to DMSs/PDMSs from the log by filtering on the	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.		
DMS-470	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in communication status (OK to failed, and failed to OK); b. changes in control mode (central, local, central override); c. changes in online-offline mode; d. changes to DMS/PDMS configuration data.	1	Demo

3.7.2.1.10 DMS/PDMS Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DMS-480	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to DMSs/PDMSs from the log database to the archived database.	1	Demo
DMS-490	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to DMSs/PDMSs from the operations database to the archived database.	1	Demo

3.7.2.2 HAR Requirements

3.7.2.2.1 Accessing the HAR System

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-10	OR-DOC-23	CapTOP shall allow the TMC Operator to access the HAR subsystem, subject to operator privilege level.	C	Demo
HAR-10.1	OR-DOC-1	CapTOP shall allow the TMC Operator to access the HAR subsystem, using the following mechanisms: a. Left clicking on a HAR icon on the map display; b. Left clicking on the HAR subsystem icon off the CapTOP toolbar; c. Left clicking on the HAR subsystem menu off the CapTOP toolbar.	1	Demo
HAR-10.2	OR-SMM-5, OR-DOC-23, OR-DOC-25	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. HAR events and alarm logs; b. Listening to current HAR recording; c. Transmission of a HAR recording; d. Creation of a HAR recording;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		e. Turning HAR transmitters on/off; f. Editing of HAR message schedule; g. HAR status (refer to HAR-40); h. Override control if a HAR is locked (if implemented); i. HAR maintenance/diagnostic status (refer to HAR-80).		
HAR-20	IR-GUI-10	CapTOP shall display all HAR icons on a separate layer on the map-based display.	1	Demo
HAR-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the HAR layer on the map display.	1	Demo
HAR-20.2	IR-GUI-10, OR-DOC-23, OR-DOC-24, OR-TID-2	CapTOP shall allow the TMC Operator to left click a HAR icon and perform the following with no more than 2 additional clicks: a. Listen to the current message recording; b. View a text version of the current message recording; c. Blank the message body of the selected HAR; d. Invoke the HAR control window (refer to HAR-140); e. View the HAR characteristics (type, location, online-offline mode, communication status); f. View the HAR status window (refer to HAR-50); g. Turn the transmitter on/off.	1	Demo
HAR-20.3	IR-GUI-12	The icons used for the HAR icon layer shall be unique from icons used in other layers.	1	Demo
HAR-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify HAR devices from the CapTOP map display (also refer to GUI-200*).	C	Demo
HAR-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new HAR icon using a pop-up menu.	1	Demo
HAR-30.2	IR-GUI-10	When a HAR device icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	1	Demo
HAR-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each HAR device to enable the device to become operational in the system: a. Controller ID; b. Description; c. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Closest Intersection/Interchange. d. Online-Offline Mode (static – set by System	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		Administrator or Maintenance Technician); e. Access code; f. Communication Type (dialup serial, network serial, IP); g. Multidrop Information; I. Drop Address; II. Channel ID; III. Port Name. h. IP Information; I. IP Address; II. Port Number. i. Dialup Information; I. Configuration Dialup Number; II. Monitor Line Number. j. Serial Information; I. Baud Rate; II. No. Data Bits; III. Parity; IV. No. Stop Bits; V. H/W Flow Control; VI. S/W Flow Control. k. NTCIP Community; l. Firmware Version; m. Cabinet Number; n. Controller Model Number; o. Protocol; p. Link ID; q. Type (synchronized, non-synchronized); r. Beacons (yes/no); s. Polling Enabled (yes/no, defaults to yes); t. Comm Loss Timeout (seconds in .1 increments); u. Associated CCTV; v. Associated DMS; w. Control Mode (central, local, central override); x. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
HAR-30.2.2	IR-GUI-10	When a HAR device icon is added, CapTOP shall prompt the System Administrator with setting the device online or offline.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo
HAR-30.3	IR-GUI-10	CapTOP shall allow a HAR device icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. allowing the device icon to be deleted.	1	Demo
HAR-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Online-Offline Mode (online/offline); h. Communication Type (dialup serial, network serial, IP); i. Protocol; j. Link ID; k. Polling Enabled (yes/no, defaults to yes); l. Associated CCTV; m. Associated DMS; n. Type (synchronized, non-synchronized); o. Beacons (yes/no); p. Control Mode (central, local, central override).	1	Demo
HAR-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
HAR-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	1	Demo
HAR-30.4.3	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.2.2.2 Monitoring HAR Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-40	OR-DOC-1, OR-DOC-23, IR-GUI-16	CapTOP shall allow the TMC Operator to retrieve and display the following operational status and operational data for any HAR, subject to operator privilege level: a. Controller ID; b. Online-offline mode (static – set by System Administrator or Maintenance Technician); c. Communication status (OK, failed); d. Control mode (central, local, central override); e. Lock status (username if locked, if implemented); f. Transmitter status (on/off); g. Recording status; I. Slot No.; II. Clip Name; III. Length (in seconds). h. Recording capacity status; I. Total recording time capacity of HAR; II. Recording time used; III. Recording time available. i. Last contact (date/time); j. Last communication status change (date/time); k. Alarm status.	C	Demo
HAR-40.1	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the HAR; b. data gained by CapTOP in attempts to communicate with the HAR; c. online/offline information entered manually by authorized CapTOP users.	C	Demo
HAR-50	SR-SYS-2, IR-GUI-29, IR-GUI-36, IR-GUI-26	CapTOP shall allow users to simultaneously view HAR status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display; b. Via the HAR status window which lists all HARs, the Controller ID, location, online-offline mode, communication status, and controller status.	C	Demo

HAR-50.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following colors for device icon states:
		a. Green=online;
		b. Green with Yellow in middle = online and message recording being broadcast;
		c. Black with Yellow in middle = online, locked, and message recording being broadcast (if locking implemented);
		d. Red = device failure;
		e. Yellow = communication failure;
		f. Gray = offline;
			C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		g. Brown = partial operation or recent failure.		
HAR-50.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: a. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; b. In order for the device icon to be green, the device must be both online and have OK communication.	C	Demo
HAR-50.2	IR-GUI-29	The refresh rate for the status of the icons and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
HAR-50.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to HAR-40 for the list of fields) by hovering over a HAR icon.	1	Demo
HAR-50.4	IR-GUI-29	CapTOP shall allow the user to select on any HAR in the HAR status window (refer to HAR-50 item b) and view all details (full status, configuration information, and HAR controls) pertaining to that HAR.	1	Demo
HAR-60	SR-SYS-2, IR-GUI-29, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a HAR by the following methods: a. by device ID; b. by IP address/drop address/channel ID/phone number; c. by street name; d. by geographical address; e. by intersection/interchange.	1	Demo
HAR-60.1	IR-GUI-32	CapTOP shall allow the TMC Operator to search for HARs using a rubber-band style box on the map display to search an area.	1	Demo
HAR-60.2	IR-GUI-32	The result of each search shall be a list of HARs that are sorted, by default, by device ID.	1	Demo
HAR-60.3	IR-GUI-32	The result of each search shall be a list of HARs sortable by device ID, IP address/drop address/channel ID/phone number, street name, geographical address, and intersection/interchange.	1	Demo
HAR-70	IR-GUI-13	CapTOP shall provide a monitoring and control interface through communication servers for managing all HARs.	C	Demo
HAR-70.1	OR-DOC-3, OR-TDCA-6, OR-DOC-25, SR-SYS-8, SR-SYS-23	CapTOP shall provide a monitor and control interface to all HARs conforming to the existing HAR's native Quixote DR1500 protocol.	C	Demo
HAR-70.1.1	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
HAR-70.2	IR-GUI-13	CapTOP shall be able to request HAR status and obtain status response data through the monitoring and control interface.	C	Demo
HAR-70.3	IR-GUI-13	CapTOP shall be able to issue control commands and receive status response through the monitoring and control interface.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-70.4	IR-GUI-17	CapTOP shall be capable of communicating to HAR devices using the following physical communication media: a. regular telephone lines; b. wireless connections (CDMA/GPRS and other modems); c. network connections.	C	Demo
HAR-80	UR-TO-25	CapTOP shall provide the TMC Operator and the Maintenance Technician the ability to monitor the status of the following: a. HAR device status (refer to HAR-40); b. HAR events and alarm logs; c. HAR online-offline mode; d. Control mode (central, local, central override); e. Communication status (OK, failed).	C	Demo
HAR-90	OR-C2F-2, OR-DWA-13	CapTOP shall be able to store HAR operational status and operational data (refer to HAR-40) in the CapTOP operations database.	1	Demo
HAR-90.1	OR-C2F-2, OR-DWA-13	CapTOP shall be able to store HAR equipment status on state transitions.	1	Demo
HAR-100	OR-TDCA-20	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and display all configuration data available from the HAR field controller/receiver.	1	Demo
HAR-110	OR-TDCA-21	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and store all configuration data in the CapTOP central system device configuration database for HAR.	1	Demo
HAR-120	OR-TDCA-22	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, download all configuration data from the CapTOP central system device configuration database to the HAR field controller/receiver.	1	Demo

3.7.2.2.3 HAR Control Commands

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-130	OR-DOC-26	CapTOP shall allow the TMC Operator to select a HAR and view a list of the defined recordings for each HAR through the CapTOP GUI.	C	Demo
HAR-130.1	OR-DOC-26	CapTOP shall provide the TMC Operator the ability to select HAR recordings from the central system's 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.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-130.2	OR-DOC-26	CapTOP shall provide the TMC Operator the ability to enter a free-form text message to be converted to an audio file, using text-to-speech conversion software, to send to a HAR.	1	Demo
HAR-130.2.1	OR-DOC-26	CapTOP shall require supervisor approval of all free-form messages stored in the library prior to their availability for transmission by the Operator to the HAR.	1	Demo
HAR-130.2.2	OR-DOC-26	CapTOP shall require supervisor approval of all audio file recordings stored in the library prior to their availability for transmission by the Operator to the HAR.	1	Demo
HAR-140	OR-DOC-24, OR-DOC-25, SR-SYS-23	CapTOP shall allow the TMC Operator to issue the following commands to any HAR, using an intuitive GUI control window, subject to operator privilege level: a. turn transmitters on/off; b. activate recorded message; c. blank message body of current recording; d. request message playback of current message recording; e. listen to the message recording being broadcast through the CapTOP workstation speakers; f. access the HAR message editor; g. edit HAR message schedule.	C	Demo
HAR-140.1	OR-DOC-27	CapTOP shall allow the TMC Operator to transmit a message recording to a HAR manually and according to a schedule, subject to operator privilege level.	C	Demo
HAR-150	OR-DOC-24, OR-DOC-25, SR-SYS-23	CapTOP shall provide the System Administrator or Maintenance Technician the ability to control the following: a. Set control mode (central, local, central override); b. Set online-offline mode; c. Set controller date/time; d. Reset controller; e. Edit and activate message recording; f. Edit HAR message schedule; g. Turn transmitters on/off.	C	Demo
HAR-160	SR-SYS-2, IR-GUI-19	CapTOP shall allow two or more different users to simultaneously control two or more different HARs at the same time.	1	Demo
HAR-170	SR-SYS-2, SR-SYS-12	CapTOP shall allow the TMC Operator, subject privilege level, to monitor and control any HAR from any CapTOP workstation.	C	Demo
HAR-180	SR-SYS-2, OR-SMM-5	CapTOP shall provide a software locking mechanism to prevent 2 or more operators from simultaneously controlling the same HAR.	3	Demo
HAR-180.1	SR-SYS-2, OR-SMM-5, OR-DOC-24	If the HAR is locked, CapTOP shall allow all TMC operators, subject to privilege level, to only view the status and listen to the current message recording or view the text of the recording of a HAR (not control).	3	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-180.2	SR-SYS-2, OR-SMM-5	CapTOP shall provide a notification to the user when he attempts to control a HAR currently locked by another user.	3	Demo
HAR-180.2.1	SR-SYS-2, OR-SMM-5	The notification shall provide the ID of the HAR and the user name that has the HAR locked.	3	Demo
HAR-190	SR-SYS-2, OR-SMM-5	CapTOP shall provide the ability for a user with override privileges to unlock HARs that are locked.	3	Demo
HAR-190.1	OR-SMM-5	CapTOP shall issue an alert to a user when a HAR that the user locked has been overridden.	3	Demo

3.7.2.2.4 HAR Message Scheduler

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-200	OR-DOC-22, OR-DOC-30	CapTOP shall be able to define and schedule HAR message recordings to be broadcast automatically using a schedule editor.	C	Demo
HAR-200.1	OR-DOC-22, OR-DOC-30	The CapTOP schedule capability shall permit time of day recurring and non-recurring entries for HAR message recordings.	C	Demo
HAR-200.2	OR-DOC-22, OR-DOC-30	The schedule shall permit a non-recurring, one-time only message recording to be transmitted to a HAR, where the user specifies a schedule name, HAR ID, message ID, reminder date/time, start date/time and end date/time.	C	Demo
HAR-200.3	OR-DOC-22, OR-DOC-30	CapTOP shall provide a recurring schedule capability and permit any of the following recurring entry types: a. Weekdays – Monday through Friday; b. Weekends – Saturday and Sunday only; c. All Days – Monday through Sunday; d. One day or any combination of days per week; e. One day or any combination of days per month.	C	Demo
HAR-200.3.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow recurring schedule entries to be created for a HAR, where the user specifies a schedule name, HAR ID, recurring entry type, message ID, reminder date/time, start date/time and end date/time (optional).	C	Demo
HAR-200.3.2	OR-DOC-22, OR-DOC-30	CapTOP shall permit an optional end date to be specified for all recurring schedule entries.	1	Demo
HAR-200.3.2.1	OR-DOC-22, OR-DOC-30	CapTOP shall implement the recurring scheduling indefinitely if no end date is specified.	1	Demo
HAR-200.3.3	OR-DOC-22, OR-DOC-30	CapTOP shall allow a Holiday schedule to be specified for the CapTOP system.	1	Demo
HAR-200.3.3.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to indicate whether each Holiday is treated as an exception to the recurring schedule.	1	Demo
HAR-200.3.3.2	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to specify each Holiday exception to be treated as either a Weekend or Weekday whenever encountered.	1	Demo
HAR-210	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to edit and delete scheduled entries for HARs.	C	Demo

3.7.2.2.5 Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-220	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to produce a report of all scheduled entries for an individual HAR or all HARs.	2	Demo
HAR-220.1	OR-DOC-22, OR-DOC-30	The report shall list all schedule entries, and shall contain the following: a. Schedule name; b. HAR ID or Group ID; c. Message ID; d. Recurrent entry type (optional); e. State Date/Time; f. End Date/Time (optional).	2	Demo
HAR-230	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status and operational data of all HARs.	2	Demo
HAR-240	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the HAR status report: a. HAR ID; b. Location; c. Online-offline mode d. Locked or unlocked status with user name (if implemented); e. Communication status (OK, failed); f. Control mode (central, local, central override); g. Message ID being broadcast; h. Alarm status.	2	Demo
HAR-250	OR-DWA-7	CapTOP shall be able to produce the following performance reports for evaluating the performance of HARs, using data in the CapTOP operations and archived databases: a. Number of times a HAR transitioned from online to offline over a specified time period; b. Number of times a HAR transitioned from no device failure to device failure over a specified time period; c. Number of times a HAR transitioned from no communication failure to communication failure over a specified time period.	2	Demo
HAR-260	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to display and print the following reports: a. For a user entered HAR ID, provide a message recording history report, consisting of the HAR ID, message ID, date/time transmitted, and username who transmitted the message. b. For a user entered user ID, provide a message recording history report, consisting of the User ID, HAR ID, message ID, and date/time transmitted.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		c. For a user entered HAR ID, provide a full device configuration report; d. For a user specified time-interval, provide a HAR message recording history report, consisting of the HAR ID, message ID, date/time transmitted, and username who transmitted the message; e. An ad-hoc report where the user can query any data stored in HAR related databases.		
HAR-260.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format. c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	a. 2 b. 2 c. 2 d. 2 e. 2 f. 2	Demo

3.7.2.2.6 HAR Message Editor

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-270	OR-DOC-25	The CapTOP software shall provide a HAR message recording editor that supports the following, subject to operator privilege: a. allows the TMC Operator to create a message recording by typing in the message and converting to an audio file using a text-to-speech conversion; b. allows the TMC Operator to select a message recording from a library; c. allows the TMC Operator to edit a typed message recording; d. allows the TMC Operator to save the new message recording as a new message in the central system's library or a replacement of an existing message in the library; e. requires the TMC Operator to provide a unique message ID for the saved message; f. allows the TMC Operator to select the state of the flashing beacons (on, off), if available for that HAR; g. requires the TMC Operator to assign a message priority to each message recording; h. provides the ability to identify and store the type of HARs that support the message;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		i. allows the operator to specify if the message is a synchronized message, and if so, the HAR IDs to synchronize together; j. allows the TMC Operator to listen to messages that were created from text; k. prohibits the TMC Operator from creating messages longer than the allowable time limit; l. allows the TMC Operator to designate the message recording as being either a header, body, or trailer message. m. displays the length in seconds of each message.		
HAR-280	OR-DOC-25	CapTOP shall spell check all created HAR message recordings, generated from free-form text, prior to storing in the central system's library, and prohibit the use of misspelled and restricted words in any message.	C	Demo
HAR-280.1	OR-DOC-25	CapTOP shall provide a configurable list of prohibited restricted words editable only by the System Administrator.	1	Demo
HAR-280.2	OR-DOC-25	CapTOP shall use a dictionary to ensure all words are spelled correctly.	1	Demo
HAR-280.3	OR-DOC-25	CapTOP shall allow the System Administrator to add, change and remove words from the dictionary.	1	Demo
HAR-280.4	OR-DOC-25	CapTOP shall provide an error message listing any words that do not pass the spell check or restricted word check.	1	Demo
HAR-280.4.1	OR-DOC-25	CapTOP shall prevent the message recording from being transmitted and saved until the errors are corrected.	1	Demo
HAR-290	OR-DOC-26	The CapTOP HAR message library in the central system shall have the following capabilities: a. be capable of storing a minimum of 1,000 message recordings; b. be capable of having a name associated with the library; c. support multiple libraries; d. be capable of creating, deleting and editing libraries and message recordings within the library, in accordance with user privileges; e. be capable of storing message recordings that are HAR-specific using a message attribute to denote the message type (Boolean variable: message specific or not); f. be capable of searching for messages in the library using a keyword or phrase; g. allows the operator to save messages with 3 parts: header, body, trailer; I. ensures that each message has a message header. II. provides the option for the operator to specify a message body; III. ensures that each message has a	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		message trailer. h. be capable of storing message recordings applicable to multiple HAR types; i. be capable of storing the message recordings in text format; j. be capable of storing the message recordings in an audio file format; k. allow the TMC Operator to delete message recordings, one at a time, in accordance with user privileges; l. allow the TMC Operator to delete all message recordings in one command in accordance with user privileges; m. allow the TMC Operator to select multiple message recordings and delete them in one command, in accordance with user privileges.		
HAR-300	OR-DOC-26, OR-DOC-28	CapTOP shall allow the same message recording to be sent to multiple HARs of the same type using a drag and drop capability, in accordance with user privileges.	1	Demo
HAR-310	OR-DOC-26, OR-DOC-28	CapTOP shall allow the same message recording to be sent to multiple HARs of the same type using a multiple selection capability, in accordance with user privileges.	1	Demo
HAR-320	OR-DOC-27	CapTOP shall notify the TMC Operator of any failed message transmissions.	1	Demo
HAR-330	OR-DOC-31	CapTOP shall take no longer than 120 seconds after initiation of message transmission to update message recording on the HAR and receive confirmation the message recording was posted via the communication protocol.	1	Demo
HAR-340	OR-DOC-31, SR-SYS-24, IR-GUI-29	CapTOP shall take no longer than 60 seconds after receipt of confirmation of message posting or failure to update the status of the HAR within the system.	1	Demo
HAR-350	OR-DOC-25, SR-SYS-23	CapTOP shall allow the TMC Operator to specify a value for an optional parameter called “maximum recorded message duration”, represented in seconds from 0-9,999,999, with a default value of 90 seconds.	1	Demo
HAR-350.1	OR-DOC-26	CapTOP shall provide a parameter that specifies the maximum length of each recorded message body, and shall be set to a default value of 60 seconds.	1	Demo
HAR-350.2	OR-DOC-26	CapTOP shall provide a parameter that specifies the maximum length of each recorded message header, and shall be set to a default value of 15 seconds.	1	Demo
HAR-350.3	OR-DOC-26	CapTOP shall provide a parameter that specifies the maximum length of each recorded message trailer, and shall be set to a default value of 15 seconds.	1	Demo
HAR-360	OR-DOC-25, SR-SYS-23	CapTOP shall require each recorded message begin with a header that announces DDOT as the owning agency and the station call symbols.	1	Demo
HAR-360.1	OR-DOC-25, SR-SYS-23	CapTOP shall prohibit the message header and station call symbols from being deleted or turned off while the HAR transmitter is on, due to FCC regulations.	1	Demo
HAR-370	OR-DOC-26	CapTOP shall be able to manage a HAR inventory of	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		100 HARs.		
HAR-380	OR-DOC-25, SR-SYS-2	CapTOP shall manage recorded messages coming from multiple operators and the system scheduler, and shall prioritize all of these into a single list and shall post the message recording with the highest priority.	1	Demo
HAR-380.1	OR-DOC-25	CapTOP shall have the ability to notify the TMC Operator, TMC Manager, and Maintenance Manager when there is a conflict with two or more message recordings, of the same priority, attempting to be sent out at the same time or within 5 minutes of one another.	1	Demo
HAR-380.2	OR-DOC-25, OR-SMM-5	CapTOP shall require a prompt and a TMC Operator override whenever a lower priority message recording is attempted to be transmitted while a higher priority message recording is being broadcast.	1	Demo
HAR-390	OR-DOC-25	CapTOP shall provide subsystem parameters to enable/disable the following: a. flashing beacons are turned on after any message recording is sent to a HAR; b. flashing beacons are turned on only after message recordings of designated priority are sent to a HAR; c. flashing beacons are always turned off after a HAR message is blanked.	1	Demo

3.7.2.2.7 HAR Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-400	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to HARs and provide the output in a time sequential log.	C	Demo
HAR-400.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to HARs: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to a HAR; c. changes to the message library (new messages, changes to existing messages; deleted messages); d. message transmission to a HAR; e. when the user changes the HAR configuration data; f. operator login; g. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo
HAR-400.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to HARs: a. any system-initiated action that attempts to, or results in, a change to the device;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		b. when the communication status changes (OK to failed, and failed to OK); c. changes in online-offline mode; d. changes in control mode (central, local, central override); e. software application login; f. software application logout; g. software application errors; h. database login; i. database logout. (Note: also refer to the LOG-* requirements).		
HAR-400.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for HARs.	1	Demo
HAR-400.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all HAR activities: a. operator input; b. operator command transmission; c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.	1	Demo
HAR-400.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (for message updates, include the device ID, message ID and summary status of HAR prior to transmission).	1	Demo
HAR-400.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
HAR-400.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo
HAR-410	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to HARs from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		e. Time stamp; f. Action type.		
HAR-420	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in communication status (OK to failed, and failed to OK); b. changes in control mode (central, local, central override); c. changes in online-offline mode; d. changes to HAR configuration data.	1	Demo

3.7.2.2.8 HAR Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HAR-430	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to HARs from the log database to the archived database.	1	Demo
HAR-440	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to HARs from the operations database to the archived database.	1	Demo

3.7.2.3 Traffic Signal Interface Requirements

3.7.2.3.1 Accessing the Traffic Signal System Interface

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-10	OR-DOC-1	CapTOP shall allow the TMC Operator to access the traffic signal status interface, subject to operator privilege level.	C	Demo
SIG-10.1	OR-DOC-1, IR-GUI-52	CapTOP shall allow the TMC Operator to access the traffic signal status interface, using the following mechanisms: a. Left clicking on a traffic signal icon on the map display; b. Left clicking on the traffic signal status interface icon off the CapTOP toolbar; c. Left clicking on the traffic signal status interface menu off the CapTOP toolbar.	1	Demo
SIG-10.2	OR-SMM-5, OR-DOC-1	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. Traffic signal events and alarms; b. Traffic signal status (refer to SIG-40.1.1 and SIG-40.1.2).	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-20	IR-GUI-10, IR-GUI-52, IR-GUI-47	CapTOP shall display the following traffic signal icons on a separate layer on the map-based display: a. 170E Phase-Based controllers; b. 170E Interval-Based controllers; c. ATC controllers; d. 170E reversible lane red X/green arrow signals; e. 170E reversible lane blank-out-signs.	1, item c priority 2	Demo
SIG-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the traffic signal layer on the map display.	1	Demo
SIG-20.2	IR-GUI-10, IR-GUI-11, IR-GUI-52	CapTOP shall allow a traffic signal device icon to be left clicked on the map display by the TMC Operator, subject to privilege level, and permit access to the traffic signal status with no more than 2 clicks.	1	Demo
SIG-20.2.1	IR-GUI-10, IR-GUI-11	CapTOP shall provide a dynamic window that shows the traffic signal status for a particular controller, using a graphical map of the intersection with the following attributes: a. Provides an accurate depiction of the intersection in terms of geometry, number of lanes, turning lanes, signal heads, and approaches. b. Provides real-time updates for the signal states (red, yellow, green, turning arrows); c. Provides access to detailed signal status in the form of a tabular window (refer to SIG-40.1.2); d. Provides access to timing plan, interval data, and phase data (refer to SIG-40.1.1) in the form of a tabular window.	1	Demo
SIG-20.2.1.1	IR-GUI-10, IR-GUI-11	CapTOP shall allow a minimum of 10 traffic signal status controller windows to be viewed simultaneously from a single CapTOP workstation.	1	Demo
SIG-20.3	IR-GUI-12	The icons used for the traffic signal icon layer shall be unique from icons used in other layers.	1	Demo
SIG-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify traffic signal devices from the CapTOP map display (also refer to GUI-200*).	C	Demo
SIG-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new traffic signal icon using a pop-up menu.	1	Demo
SIG-30.2	IR-GUI-10	When a traffic signal device icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	1	Demo
SIG-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each traffic signal device to enable the device to become operational in the system: a. Controller ID; b. ACISA Number; c. Controller Type (170E or ATC); d. Control Type (Interval or Phase);	1, ATC portion of item c priority 2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		e. Location Information: I. Location Description; II. Intersection/Interchange name (at least 2 streets, for roundabout will be more than 2 streets). f. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); g. Communication Type (dialup serial, network serial, IP); h. Multidrop Information; I. Drop Address; II. Channel ID; III. Port Name. i. IP Information; I. IP Address; II. Port Number. j. Serial Information; I. Baud Rate; II. No. Data Bits; III. Parity; IV. No. Stop Bits; V. H/W Flow Control; VI. S/W Flow Control. k. NTCIP Community; l. Firmware Version; m. Cabinet Number; n. Controller Model Number; o. Protocol; p. Link ID; q. Polling Enabled (yes/no, defaults to yes); r. Comm Loss Timeout (seconds in .1 increments); s. Associated HAR; t. Associated DMS; u. Associated CCTV; v. Control Mode (central, local, central override); w. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
SIG-30.2.2	IR-GUI-10	When a traffic signal device icon is added, CapTOP shall prompt the System Administrator or Maintenance	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		Technician with setting the device online or offline.		
SIG-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo
SIG-30.3	IR-GUI-10, IR-GUI-11, IR-GUI-44, IR-GUI-45	CapTOP shall allow a traffic signal device icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. allowing the user to launch the QuicNet client or the ATC software for signal control based on controller type; e. allowing the device icon to be deleted.	1, ATC portion of item d priority 2	Demo
SIG-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Intersection/Interchange. b. Controller Type (170E or ATC); c. Control Type (Interval or Phase); d. Online-Offline Mode (online/offline); e. Communication Type (dialup serial, network serial, IP); f. Link ID; g. Polling Enabled (yes/no, defaults to yes); h. Associated HAR; i. Associated DMS; j. Associated CCTV; k. Control Mode (central, local, central override).	1, ATC portion of item d priority 2	Demo
SIG-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
SIG-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
SIG-30.4.3	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.2.3.2 Monitoring Traffic Signal Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-40	OR-DOC-10, IR-GUI-14, IR-GUI-16, IR-GUI-47	CapTOP shall support the monitoring of five (5) types of traffic signal and reversible lane controllers: a. 170E phase-based signal controller; b. 170E interval-based signal controller; c. ATC phase-based signal controller; d. 170E reversible lane controller using red X and green arrow signals; e. 170E reversible lane controller using blank-out-signs.	C,item c priority 2	Demo
SIG-40.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8, IR-GUI-14, IR-GUI-16,OR-DOC-6, OR-DOC-7, OR-DOC-10, IR-GUI-44, IR-GUI-47, IR-GUI-45, IR-GUI-52	CapTOP shall support data acquisition from the Traffic Signal System to support operational status monitoring.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-40.1.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8, IR-GUI-14, IR-GUI-16,OR-DOC-6, OR-DOC-7, OR-DOC-10, IR-GUI-44, IR-GUI-47, IR-GUI-45, IR-GUI-52	CapTOP shall allow the TMC Operator to retrieve and display the following configuration operational status and operational data for any traffic signal controller, subject to operator privilege level: a. Controller ID; b. ACISA Number; c. Location Information: I. Location Description; II. Intersection/Interchange (at least 2 streets, for roundabout will be more than 2 streets). d. Controller Type (170E or ATC); e. Control Type (Interval or Phase); f. For 170E Phase-Based controllers: I. All phase table data; II. All timing plan data; II. Operational mode (coordination, manual, flash, preemptive, adaptive). g. For 170E Interval-Based controllers: I. Split, cycle, offsets; II. Interval timing countdown information; III. All timing plan data; IV. Operational mode (coordination, manual, flash, preemptive). h. For ATC controllers: I. Patterns, splits, phase sequences (for ATC only); II. All phase table data; III. Operational mode (coordination, manual, flash, preemptive, adaptive). i. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); j. Control Mode (central, local, central override); k. Physical Geometry of the intersection with signal status illustrated graphically.	C, ATC portion of item d priority 2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-40.1.2	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8, IR-GUI-14, IR-GUI-16,OR-DOC-6, OR-DOC-7, OR-DOC-10, IR-GUI-44, IR-GUI-47, IR-GUI-45, IR-GUI-52	CapTOP shall allow the TMC Operator to retrieve and display the following dynamic operational status and operational data for any traffic signal controller, subject to operator privilege level: a. Controller ID; b. Controller Type (170E or ATC); c. Control Type (Interval or Phase); d. For 170E Phase-Based controllers: I. Current phase status (red, yellow, green for each phase on each approach); II. Current timing plan in effect; III. Operational mode (coordination, manual, flash, preemptive, adaptive). e. For 170E Interval-Based controllers: I. Current signal status (red, yellow, green) for each interval for each approach; II. Interval timing countdown information; III. Current timing plan in effect; IV. Operational mode (coordination, manual, flash, preemptive). f. For ATC controllers: I. Current signal status (red, yellow, green) for each phase on each approach; II. Detection malfunction status; III. Operational mode (coordination, manual, flash, preemptive, adaptive); IV. UPS status (OK, failed); V. Battery voltage; VI. Battery status (normal, low voltage). g. For 170E controllers with reversible lane red X/green arrow signals: I. Red X and green arrow signal status. h. For 170E controllers with reversible lane blank-out-signs: I. blank-out-sign status. i. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); j. Controller Status (OK, failed); k. Communication Status (OK, failed); l. Control Mode (central, local, central override); m. Current Signal Status of the pedestrian signal; n. Alarm Status;	C, ATC portion of item d priority 2	Demo
SIG-40.2	OR-DOC-1	CapTOP shall be able to monitor all traffic signals by interfacing with the Traffic Signal System to determine their operational status.	C	Demo
SIG-40.2.1	IR-GUI-14	CapTOP shall prohibit traffic signal controller changes through this interface.	C	Demo
SIG-40.2.2	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-40.2.3	IR-GUI-14, IR-GUI-44	CapTOP shall be able to request 170E traffic signal status and obtain status response data through the traffic signal status interface on the existing QuicNet signal server.	C	Demo
SIG-40.2.3.1	OR-DOC-3	CapTOP shall interface with QuicNet 170E Traffic Signal System in accordance with the QuicNet API (refer to the "Washington DC Data Interface to QuicNet/4, version 2.0" document revised on 2/26/2009, or the latest available revision, that correlates with DDOT's current software) to access traffic signal status for 170E-based intersections.	C	Demo
SIG-40.2.4	IR-GUI-14	CapTOP shall be able to request ATC traffic signal status and obtain status response data through the traffic signal status interface on the future ATC signal server.	2	Demo
SIG-40.2.4.1	OR-DOC-3	CapTOP shall interface with ATC Traffic Signal System in accordance with the future ATC Signal System API (to be published) to access traffic signal status for ATC-based intersections.	2	Demo
SIG-40.3	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the Traffic Signal System; b. data gained by CapTOP in attempts to communicate with the Traffic Signal System; c. online/offline information entered manually by authorized CapTOP users.	C	Demo
SIG-60	SR-SYS-2, IR-GUI-36, IR-GUI-26	CapTOP shall allow users to simultaneously view traffic signal status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display (refer to SIG-20.2); b. Via the traffic signal summary status window which lists all traffic signals, the Controller ID, ACISA number, location, online-offline mode, communication status, and controller status.	C	Demo

SIG-60.1	IR-GUI-28, IR-GUI-26, OR-EM-7	CapTOP shall use the following colors for device icon states:
		a. Solid Green = online and cycling;
		b. Solid Yellow = online and flashing signals;
		c. Solid Red = offline;
		d. Orange = device failure;
		e. Brown = communication failure.
			C	Demo

SIG-60.1.1	IR-GUI-28, IR-GUI-26, OR-EM-7	CapTOP shall use the following rules for device icon states: a. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; b. In order for the device icon to be green, the device must be both online and have OK communication.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-60.2	IR-GUI-31, IR-GUI-29	The refresh rate for the status of the icons on the map display and for the data in the traffic signal summary status window shall be configurable and based upon the polling rate.	1	Demo
SIG-60.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to SIG-60.b for the list of fields) by hovering over a traffic signal controller icon.	1	Demo
SIG-60.4	IR-GUI-31	The traffic signal summary status window shall allow the user to click on an individual row and access the detailed traffic signal status and configuration information for a particular controller (refer to SIG-60).	C	Demo
SIG-70	SR-SYS-2, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a traffic signal by the following methods: a. by controller ID; b. by ACISA number; c. by IP address/drop address/channel ID of the controller; d. by street name; e. by geographical address; f. by intersection/interchange.	C	Demo
SIG-70.1	SR-SYS-2, IR-GUI-31	CapTOP shall allow the TMC Operator to search for traffic signals using a rubber-band style box on the map display to search an area.	C	Demo
SIG-70.2	SR-SYS-2, IR-GUI-31	The result of each search shall be a list of traffic signals that are sorted, by default, by Controller ID.	1	Demo
SIG-70.3	SR-SYS-2, IR-GUI-31	The result of each search shall be a list of traffic signals sortable by Controller ID, ACISA number, IP address/drop address/channel ID, street name, geographical address, and intersection/ interchange.	1	Demo
SIG-80	UR-TO-25	CapTOP shall provide the Maintenance Technician the ability to monitor the status and operational data from any controller (refer to SIG-40.1.1 and SIG-40.1.2).	1	Demo
SIG-90	OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall be able to store traffic signal operational status in the CapTOP operations database.	1	Demo
SIG-90.1	OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall update configuration operational status (refer to SIG-40.1.1) in the CapTOP operational database when the data values reported to CapTOP have changed.	1	Demo
SIG-90.2	OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall store dynamic operational status (refer to SIG-40.1.2) in the CapTOP operational database on at a parameter frequency (default of once per 15 seconds).	1	Demo
SIG-100	OR-TDCA-21	CapTOP shall be able to, at the System Administrator's or Maintenance Technician's request, upload and store all traffic signal field controller/ receiver configuration data in the CapTOP central system device configuration database for traffic signals.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-110	IR-GUI-47	For signal controllers that have red X/green arrow signals connected to the controller, CapTOP shall provide the TMC Operator a map-based display to retrieve and display the following status of reversible lanes: a. Controller ID; b. ACISA Number; c. Controller Type (170E or ATC); d. Location Information: I. Location Description; II. Intersection/Interchange (at least 2 streets, for roundabout will be more than 2 streets). e. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); f. Communication Type (dialup serial, network serial, IP); g. Red X/Green Arrow Status; h. Direction of travel.	C, ATC portion of item c priority 2	Demo
SIG-120	IR-GUI-14, IR-GUI-47	For signal controllers that have blank-out-signs connected to the controller, CapTOP shall provide the TMC Operator a map-based display to retrieve and display the following status of reversible lanes: a. Controller ID; b. ACISA Number; c. Controller Type (170E or ATC); d. Location Information: I. Location Description; II. Intersection/Interchange (at least 2 streets, for roundabout will be more than 2 streets). e. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); f. Communication Type (dialup serial, network serial, IP); g. Blank-out-status (2 lanes in use or 3 lanes in use).	C, ATC portion of item c priority 2	Demo
SIG-130	OR-DOC-36	CapTOP shall be able to receive and track the operational status of transit signal priority via QuicNet and the future Traffic Signal System.	C	Demo
SIG-140	OR-EM-7	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. (Refer to SIG-70).	C	Demo

3.7.2.3.3 Traffic Signal Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-170	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status and operational data of all traffic signals.	2	Demo
SIG-170.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8, IR-GUI-44, IR-GUI-45	CapTOP shall provide the following information in the traffic signal status summary report: a. Controller ID; b. ACISA Number; c. Controller Type (170E or ATC); d. Control Type (Interval or Phase); e. Alarm status; f. Detection malfunction status (ATC only); g. Online-Offline Mode; h. Controller Status (OK, failed); i. Control Mode (central, local, central override); j. Communication Status (OK, failed).	2	Demo
SIG-170.2	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8, IR-GUI-44, IR-GUI-45, OR-DOC-6, OR-DOC-7	CapTOP shall provide all status and operational data (refer to SIG-40.1.1 and SIG-40.1.2) in the traffic signal extended status report.	2	Demo
SIG-170.3	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to provide a full device configuration report for a user entered Controller ID.	2	Demo
SIG-180	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce the following performance reports for evaluating the performance of traffic signals, using data in the CapTOP operations and archived databases: a. Number of times a traffic signal transitioned from online to offline over a specified time period; b. Number of times a traffic signal transitioned from no device failure to device failure over a specified time period; c. Number of times a traffic signal transitioned from no communication failure to communication failure over a specified time period.	2	Demo
SIG-190	OR-DWA-7, OW-DWA-5	CapTOP shall support an ad-hoc report generation capability that allows the user to build and specify their own queries based on data stored in signal related databases.	2	Demo
SIG-200	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format;	a. 2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format. c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	b. 2 c. 2 d. 2 e. 2 f. 2	

3.7.2.3.4 Traffic Signal Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-210	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to traffic signals and provide the output in a time sequential log.	C	Demo
SIG-210.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to traffic signals: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to a device; c. operator login; d. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo
SIG-210.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to traffic signals: a. any system-initiated action that attempts to, or results in, a change to the device; b. when the communication status changes (OK to failed, and failed to OK); c. changes in online-offline mode; d. software application login; e. software application logout; f. database login; g. database logout. (Note: also refer to the LOG-* requirements).	1	Demo
SIG-210.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for traffic signals.	1	Demo
SIG-210.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all traffic signal activities: a. operator error; b. operator informational message; c. system warning; d. system error; e. system information message; f. software application warning; g. software application error;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		h. software application information message.		
SIG-210.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the controller ID, description of action, and summary status of controller).	1	Demo
SIG-210.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
SIG-210.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	1	Demo
SIG-220	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to traffic signals from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.	1	Demo
SIG-230	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in communication status (OK to failed, and failed to OK); b. changes in control mode (central, local, central override); c. changes in online-offline mode; d. changes to traffic signal configuration data.	1	Demo

3.7.2.3.5 Traffic Signal Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SIG-240	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to traffic signals from the log database to the archived database.	1	Demo
SIG-250	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to traffic signals from the operations database to the archived database.	1	Demo

3.7.3 Incident Management Requirements (including Special Event Management)

Note: prior to reading this section, please refer to the Definitions section 1.5 of this document to understand the meaning of the term "incident".

3.7.3.1 Accessing the Incident Management System

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-10	OR-IM-35	CapTOP shall provide an event-driven incident management subsystem and shall allow the TMC Operator to access the Incident Management subsystem, subject to operator privilege level.	C	Demo
INM-10.1	OR-IM-35, IR-GUI-21, IR-GUI-22, UR-TO-7, UR-TO-8	CapTOP shall allow the TMC Operator to access the Incident Management subsystem, using the following mechanisms: a. Left clicking on an incident icon on the map display; b. Left clicking on the Incident Management subsystem icon off the CapTOP toolbar; c. Left clicking on the Incident Management subsystem menu off the CapTOP toolbar.	1	Demo
INM-10.2	OR-SMM-5	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. Incident Management events and alarm logs (refer to INM-430.1 and 430.1.1); b. Incident Management status (refer to INM-40.1); c. Incident creation (declaration) functions; d. Incident Management response functions; e. Special event scheduling planning functions; f. Incident Management reports; g. Override access when an incident is locked (System Administrator only).	C	Demo
INM-20	IR-GUI-10, IR-GUI-35	CapTOP shall display incident icons on separate layers on the map-based display (refer to INM-50.1 for icon colors).	1	Demo
INM-20.1	IR-GUI-12	CapTOP shall display DDOT detected incidents on its own layer on the map display.	1	Demo
INM-20.2	IR-GUI-12	CapTOP shall display external incidents on its own layer on the map display.	1	Demo
INM-20.3	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off each incident icon layer on the map display independently.	1	Demo
INM-20.4	IR-GUI-10, IR-GUI-36, UR-TO-21	CapTOP shall allow an incident icon on the DDOT layer to be left clicked on the map display by the TMC Operator and permit access to the Incident Management status window (refer to INM-40.1 and INM-60), with no more than 2 additional clicks.	1	Demo
INM-20.5	IR-GUI-12	The icons used for the incident icon layer shall be unique from icons used in other layers.	1	Demo
INM-30	OR-IM-10	CapTOP shall allow the TMC Operator to manually input and modify incident data using the map display	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		and pull-down menus via data-entry interfaces.		
INM-30.1	IR-GUI-10, IR-GUI-20	CapTOP shall provide the ability for the TMC Operator to add, delete, and modify incident icons on the CapTOP map display (also refer to GUI-200*).	C	Demo
INM-30.1.1	IR-GUI-10, IR-GUI-20	CapTOP shall allow the TMC Operator to point and click on a location on the map display to add a new incident icon using a pop-up menu.	1	Demo
INM-30.1.1.1	IR-GUI-10, IR-GUI-20	CapTOP shall prohibit adding, deleting or moving incident icons until the map is zoomed to a scale of 1" = X feet or less, where X has a default value of 1000 feet, and where X is configurable by the System Administrator.	1	Demo
INM-30.1.2	OR-IM-5, IR-GUI-40, IR-GUI-41	CapTOP shall provide users a map-based display to geocode incident locations on the GIS map.	1	Demo
INM-30.2	IR-GUI-24	CapTOP shall allow users to enter the location of new incidents using the following methods: a. geocoding; b. latitude/longitude; c. cross streets.	C	Demo
INM-30.2.1	IR-GUI-10, IR-GUI-21 OR-TDCA-19, OR-IM-4, OR-SEPM-1, OR-SEPM-28 SR-SYS-25, IR-GUI-38, UR-TO-14, OR-TOM-2, IR-GUI-56, IR-GUI-57	CapTOP shall provide the TMC Operator with data entry forms to store the following incident information in the CapTOP operations database: a. incident ID (generated by system); b. incident name; c. incident description; d. incident type (refer to INM-30.2.1.1); e. incident severity (minor, major, regional, coastal, nationwide); f. incident status (refer to INM-30.2.1.10); g. incident location: I. Location Description; II. Street Address/Block; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Closest Intersection/Interchange; VIII. Latitude (decimal degrees); IX. Longitude (decimal degrees); X. Quadrant; XI. Ward. h. incident reported date; i. incident reported time; j. incident end date; k. incident end time; l. last update date; m. last update time; n. detection time (for CIPS detections only); o. confirmed (yes/no); p. confirmation date and time (n/a for special events);	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		q. incident response plan name (filled in by the system once an incident response plan is selected by the operator); r. resources used: I. number of DDOT employees involved; II. number of signs used; III. number of cones required; IV. the type and quantity of equipment used; V. ROPS involved. s. source of incident; t. weather conditions; u. traffic conditions; v. agencies notified. w. agencies involved; x. incident commander; y. TMC operators involved z. traffic accident information: I. accident subtype (refer to INM-30.2.1.1.1); II. number of lanes blocked; III. list of lanes blocked (refer to INM-30.2.1.3); IV. type of lanes blocked (refer to INM-30.2.1.4). V. number of vehicles involved; VI. type of vehicles involved; VII. personal injuries; VIII. number of fatalities; IX. property damage. aa. weather event information: I. weather event subtype (refer to INM-30.2.1.1.1); II. travel condition (refer to INM-30.2.1.5); III. pavement condition (refer to INM-30.2.1.6); IV. precipitation type (rain, snow, ice, sleet, hail); V. wind condition (gusty, nominal, minimal, none); VI. area affected (coastal, regional, local). bb. construction/maintenance incident information: I. construction/maintenance incident subtype (refer to INM-30.2.1.1.1); II. number of lanes blocked; III. list of lanes blocked (refer to INM-30.2.1.3); IV. type of lanes blocked (refer to INM-30.2.1.4); V. event start date; VI. event start time; VII. event end date;		

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		VIII. event end time. cc. road closure event: I. road closure subtype (refer to INM-30.2.1.1.1); II. number of lanes blocked; III. list of lanes blocked (refer to INM-30.2.1.3); IV. type of lanes blocked (refer to INM-30.2.1.4); V. event start date; VI. event start time; VII. event end date; VIII. event end time. dd. special event information: I. special event subtype (refer to INM-30.2.1.1.1); II. contact information of source (if applicable); III. event sponsor; IV. number of attendees; V. name of event; VI. key contacts; VII. written description of traffic management strategy; VIII. setup time; IX. transit options available; X. traffic routes available; XI. event start date; XII. event start time; XIII. event end date; XIV. event end time. ee. electronic device outage: I. electronic device outage subtype (refer to INM-30.2.1.1.1); II. number of lanes blocked; III. list of lanes blocked (refer to INM-30.2.1.3); IV. type of lanes blocked (refer to INM-30.2.1.4); V. contact name; VI. event start date (if scheduled); VII. event start time (if scheduled); VIII. event end date (if scheduled); IX. event end time (if scheduled). ff. security incident: I. security incident subtype (refer to INM-30.2.1.1.1); II. threat level (severe, high, elevated, guarded, low); III. area affected (nation-wide, inter-state, state, regional, local). gg. comments.		
INM-30.2.1.1	IR-GUI-10, IR-GUI-53	CapTOP shall support the following types of incidents: a. Traffic accident:	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		b. Weather event: c. Construction/Maintenance event: d. Road closure event: e. Special event: f. Electronic device outage: g. Security incident: h. Other.		
INM-30.2.1.1.1	IR-GUI-10, SR-SYS-11	CapTOP shall support the following subtypes of incidents: a. Traffic accident: I. accident; II. serious-accident; III. injury-accident; IV. minor-accident; V. multi-vehicle-accident; VI. numerous-accidents; VII. accident-involving-a-bicycle; VIII. accident-involving-a-bus; IX. accident-involving-a-motorcycle; X. accident-involving-a-pedestrian; XI. accident-involving-a-train; XII. accident-involving-a-truck; XIII. accident-involving-hazardous-materials; XIV. earlier-accident; XV. medical-emergency; XVI. secondary-accident; XVII. rescue-and-recovery-work-in-progress; XVIII. accident-investigation-work; XIX. stalled-vehicle; XX. abandoned-vehicle; XXI. disabled-vehicle; XXII. disabled-truck; XXIII. disabled-semi-trailer; XXIV. disabled-bus; XXV. disabled-train; XXVI. vehicle-spun-out; XXVII. vehicle-on-fire; XXVIII. vehicle-in-water; XXIX. vehicles-slowing-to-look-at-accident; XXX. jackknifed-semi-trailer; XXXI. jackknifed-trailer-home; XXXII. jackknifed-trailer; XXXIII. spillage-occurring-from-moving-vehicle; XXXIV. acid-spill; XXXV. HATMAT/chemical-spill; XXXVI. fuel-spill; XXXVII. hazardous-materials-spill; XXXVIII. oil-spill; XXXIX. spilled-load; XL. toxic-spill; XLI. overturned-vehicle; XLII. overturned-truck; XLIII. overturned-semi-trailer; XLIV. overturned-bus;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		XLV. derailed-train; XLVI. stuck-vehicle; XLVII. truck-stuck-under-bridge; XLVIII. bus-stuck-under-bridge; XLIX. major crash; L. Other. b. Weather event: I. Snow event; II. Ice event; III. Sleet event; IV. Rain event; V. Fog event; VI. Other. c. Construction/Maintenance event: I. Street repair; II. Alley repair; III. Sidewalk repair; IV. Grass and weeds repair; V. Other. d. Road Closure event: I. Debris on Roadway; II. Fallen Tree; III. Manhole Explosion; IV. Water Main Break; V. Building fires; VI. Floods; VII. Other. e. Special event: I. Football game; II. Baseball game; III. Hockey game; IV. Basketball game; V. Soccer game; VI. Evacuation; VII. Parade; VIII. Marathon; IX. Runs; X. Charity Walks; XI. Bicycle Race; XII. Festival; XIII. Inauguration; XIV. National funeral; XV. Papal event; XVI. 4th of July; XVII. International conferences; XVIII. Other. f. Electronic device outage: I. Traffic Signal System outage; II. Street/Alley Lights outage; III. Sign outage; IV. Power outage; V. Other. g. Security incident: I. Suspicious Package;		

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		II. Suspicious Vehicle; III. Suspicious Person; IV. Bomb explosion; V. Crime; VI. Robbery; VII. Shooting; VIII. Gunfire-on-roadway; IX. Protest event; X. Demonstration; XI. March; XII. Public-disturbance; XIII. Riot; XIV. Strike; XV. Checkpoint; XVI. Bomb-alert; XVII. Terrorist-incident; XVIII. Other. h. Other.		
INM-30.2.1.2	OR-SEPM-19	CapTOP shall provide separate windows, or a hide/show capability, to enter information specific to traffic accidents and special event types.	1	Demo
INM-30.2.1.2.1	OR-SEPM-19	CapTOP shall provide separate windows to enter information specific to traffic accidents.	1	Demo
INM-30.2.1.2.2	OR-SEPM-19	CapTOP shall provide separate windows to enter information specific to special events.	1	Demo
INM-30.2.1.3	OR-SEPM-19	CapTOP shall allow the TMC Operator to specify which lanes are blocked/closed for each incident: a. full road; b. left-lane; c. right-lane; d. center-lane; e. middle-lanes; f. middle-two-lanes; g. through lane; h. right-turning-lanes; i. left-turning-lanes; j. right-exit-ramp; k. right-entrance-ramp; l. left-exit-ramp; m. left-entrance-ramp; n. hard-shoulder; o. soft-shoulder; p. right-shoulder; q. left-shoulder; r. right collector lanes; s. left collector lanes; t. bicycle-lane.	C	Demo
INM-30.2.1.4	OR-SEPM-19	CapTOP shall allow the TMC Operator to specify the following types of lanes blocked/closed for each incident: a. bridge; b. overpass; c. elevated; d. underpass;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		e. arterial; f. freeway; g. residential; h. tunnel; i. connecting; j. express; k. local; l. toll (future); m. electronic-toll-lanes (future); n. toll-plaza; o. inspection; p. HOV; q. bus; r. carpool; s. truck.		
INM-30.2.1.5	IR-GUI-10, SR-SYS-11	CapTOP shall provide the TMC Operator with the capability to associate the following travel conditions with weather events: a. almost-impassable; b. passable-with-care; c. passable; d. danger-of-hydroplaning; e. surface-water-hazard; f. snow-cleared; g. pavement-conditions-improved; h. skid-hazard-reduced; i. road-surface-in-poor-condition; j. pavement-conditions-cleared.	C	Demo
INM-30.2.1.6	IR-GUI-10, SR-SYS-11	CapTOP shall provide the TMC Operator with the capability to associate the following pavement conditions with weather events: a. wet-pavement; b. treated-pavement; c. slippery; d. mud-on-roadway; e. leaves-on-roadway; f. loose-sand-on-roadway; g. loose-gravel; h. fuel-on-roadway; i. oil-on-roadway; j. melting-tar; k. ice; l. icy-patches; m. black-ice; n. ice-pellets-on-roadway; o. ice-build-up; p. freezing-rain; q. wet-and-icy-roads; r. melting-snow; s. slush; t. frozen-slush; u. snow-on-roadway; v. packed-snow; w. packed-snow-patches;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		x. plowed-snow; y. wet-snow; z. fresh-snow; aa. powder-snow; bb. granular-snow; cc. frozen-snow; dd. crusted-snow; ee. deep-snow; ff. snow-drifts; gg. drifting-snow; hh. expected-snow-accumulation; ii. current-snow-accumulation; jj. dry-pavement.		
INM-30.2.1.7	OR-SEPM-19	CapTOP shall provide the TMC Operator with the capability to define approved special events in the operations database to support pre-event planning.	C	Demo
INM-30.2.1.8	OR-IM-72	CapTOP shall support a common code-naming system for incident data records to share with other agencies, by enforcing the data names and types as defined in the latest version of ITE's Traffic Management Data Dictionary.	3	Demo
INM-30.2.1.9	OR-IM-6	CapTOP shall provide the TMC Operator a data-entry interface incorporating range checking with configurable limits and error checking into all data entry fields.	1	Demo
INM-30.2.1.9.1	OR-IM-8	CapTOP shall provide the TMC Operator with error messages to allow for correcting any improper entry of incident data.	1	Demo
INM-30.2.1.10	OR-IM-4	CapTOP shall allow each incident to be assigned one of the follow incident status values: a. active; b. clearing; c. ended; d. planned; e. forecast; f. contingency-plan; g. response-plan-activated; h. reported; i. confirmed; j. responding; k. updated; l. deleted; m. cancelled; n. postponed; o. reopened.	1	Demo
INM-30.2.1.11	OR-IM-4	CapTOP shall automatically populate the Incident ID field using database features.	1	Demo
INM-30.2.12	IR-GUI-10	If the user enters, or the system receives, a latitude/longitude pair for the incident location, the icon location on the map shall be updated automatically based on the coordinates specified.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-30.2.2	OR-IM-7, IR-GUI-39	CapTOP shall require mandatory fields about each incident type to be entered by the user at the time incidents are created.	C	Demo
INM-30.2.2.1	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields to be entered by the user for all incident types: a. incident name; b. incident type; c. incident severity; d. incident status (refer to INM-30.2.1.10); e. incident description; f. incident reported date; g. incident reported time; h. incident location.	C	Demo
INM-30.2.2.2	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields about traffic accidents to be entered by the user at the time incidents are created: a. accident subtype (refer to INM-30.2.1.1.1); b. number of lanes blocked; c. list of lanes blocked (refer to INM-30.2.1.3); d. type of lanes blocked (refer to INM-30.2.1.4). e. number of vehicles involved; f. type of vehicles involved; g. personal injuries; h. number of fatalities; i. property damage.	C	Demo
INM-30.2.2.3	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields about weather events to be entered by the user at the time incidents are created: a. weather event subtype (refer to INM-30.2.1.1.1); b. travel condition (refer to INM-30.2.1.5); c. pavement condition (refer to INM-30.2.1.6); d. precipitation type (rain, snow, ice, sleet, hail); e. wind condition (gusty, nominal, minimal, none); f. area affected (coastal, regional, local).	C	Demo
INM-30.2.2.4	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields about construction/maintenance events to be entered by the user at the time incidents are created: a. construction/maintenance incident subtype (refer to INM-30.2.1.1.1); b. number of lanes blocked; c. list of lanes blocked (refer to INM-30.2.1.3); d. type of lanes blocked (refer to INM-30.2.1.4); e. event start date; f. event start time; g. event end date; h. event end time.	C	Demo
INM-30.2.2.5	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields about road closure events to be entered by the user at the time incidents are created: a. road closure subtype (refer to INM-30.2.1.1.1); b. number of lanes blocked; c. list of lanes blocked (refer to INM-30.2.1.3);	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		d. type of lanes blocked (refer to INM-30.2.1.4); e. event start date; f. event start time; g. event end date; h. event end time.		
INM-30.2.2.5.1	OR-CMM-1	CapTOP shall provide the ability to receive road closure (work zone) locations and status from other DC agencies.	2	Demo
INM-30.2.2.5.1.1	OR-MMC-1	CapTOP shall interface with the DDOT online Emergency Permit Request website to retrieve permit information for utility companies emergency repair requests.	2	Demo
INM-30.2.2.5.1.2	OR-MMC-2	CapTOP shall interface with the DDOT permitting office to receive information about permits for lane/road closures due to utility repairs.	2	Demo
INM-30.2.2.5.2	OR-CMM-2	CapTOP shall provide an interface with other DC agencies to access the road closure (work zone) database to obtain the following data: d. the list of authorized full and partial short-term road closures. e. the list of authorized full and partial long-term road closures. f. the allowable work hours and lane closure times, setup times, infrastructure repair description, and road obstructions.	2	Demo
INM-30.2.2.6	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields about special events to be entered by the user at the time incidents are created: a. special event subtype (refer to INM-30.2.1.1.1); b. contact information of source (if applicable); c. event sponsor; d. number of attendees; e. name of event; f. type of event; g. key contacts; h. traffic management strategy; i. setup time; j. transit options available; k. traffic routes available; l. event start date; m. event start time; n. event end date; o. event end time.	C	Demo
INM-30.2.2.7	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields about electronic device outages to be entered by the user at the time incidents are created: a. electronic device outage subtype (refer to INM-30.2.1.1.1); b. number of lanes blocked; c. list of lanes blocked (refer to INM-30.2.1.3); d. type of lanes blocked (refer to INM-30.2.1.4); e. contact name; f. event start date;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		g. event start time; h. event end date; i. event end time.		
INM-30.2.2.8	OR-IM-7, IR-GUI-39	CapTOP shall require the following mandatory fields about security incidents to be entered by the user at the time incidents are created: a. security incident subtype (refer to INM-30.2.1.1.1); b. threat level (severe, high, elevated, guarded, low); c. area affected (nation-wide, inter-state, state, regional, local).	C	Demo
INM-30.3	IR-GUI-10, IR-GUI-23, IR-GUI-56, IR-GUI-57	CapTOP shall allow an incident device icon to be right clicked on the map display and permit access to the following functions by the TMC Operator, with no more than 2 additional clicks: a. Set the incident status to “ended”; b. Set the incident status to “clearing”; c. Set the incident status to “active”; d. Set the incident status to “planned” (for special events only); e. Open the incident status window to update fields; f. Allow the icon to be relocated on the map display; g. Allow the icon to be deleted; h. Display affected area (for special events and road closures only) graphically on the map display.	1	Demo
INM-30.3.1	IR-GUI-10, IR-GUI-23	When the incident status is set to “ended”, the icon shall turn gray and disappear automatically after a parameter (default value of 30 minutes) time period.	C	Demo
INM-30.3.1.1	IR-GUI-10, IR-GUI-23	When the incident status is set to “ended”, CapTOP shall require the operator to enter the incident end date and incident end time.	C	Demo
INM-30.3.1.1.1	IR-GUI-10, IR-GUI-23	CapTOP shall default the incident end date and end time fields to the current date and time, respectively.	1	Demo
INM-30.3.1.2	IR-GUI-10, IR-GUI-23	When the incident status is set to “ended”, CapTOP shall require the operator to enter the effectiveness of the response plan and to note any suggested changes.	1	Demo
INM-30.3.1.2.1	IR-GUI-10, IR-GUI-23	The system shall email the TMC Manager of any suggested changes with a reminder to update the response plan, as required.	1	Demo
INM-30.3.2	IR-GUI-10, IR-GUI-23, IR-GUI-57	When the user requests to display the affected area for a special event the area affected shall be highlighted on the map.	1	Demo
INM-30.3.3	IR-GUI-10, IR-GUI-23, IR-GUI-57	When the user requests to display the affected area for a road closure event a graphic shall be displayed that shows the lane and geometry detail of the closed areas.	1	Demo
INM-30.3.3.1	IR-GUI-10, IR-GUI-23	CapTOP shall display closed lanes/shoulders in red and open lanes/shoulders in black.	1	Demo
INM-30.4	OR-SEPM-20,	CapTOP shall allow the user to update the status of any incident at any time.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	IR-GUI-56, IR-GUI-57			
INM-30.4.1	OR-SEPM-20	CapTOP shall update the last update date/time field stored with each incident any time that any field in the incident record is updated.	1	Demo
INM-30.5	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: <u>Location Fields</u> a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Closest Intersection/Interchange; g. Latitude (decimal degrees); h. Longitude (decimal degrees); i. Quadrant; j. Ward. <u>Incident Fields</u> a. incident type (refer to INM-30.2.1.1); b. incident severity (minor, major, regional, coastal, nationwide); c. incident status (refer to INM-30.2.1.10); d. confirmed (yes/no); e. source of incident; f. weather conditions; g. traffic conditions; h. agencies notified. i. agencies involved; j. incident commander; k. TMC operators involved l. traffic accident information: I. accident subtype (refer to INM-30.2.1.1.1); II. list of lanes blocked (refer to INM-30.2.1.3); III. type of lanes blocked (refer to INM-30.2.1.4). IV. type of vehicles involved; V. personal injuries; VI. property damage. m. weather event information: I. weather event subtype (refer to INM-30.2.1.1.1); II. travel condition (refer to INM-30.2.1.5); III. pavement condition (refer to INM-30.2.1.6); IV. precipitation type (rain, snow, ice, sleet, hail); V. wind condition (gusty, nominal,	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		minimal, none); VI. area affected (coastal, regional, local). n. construction/maintenance incident information: I. construction/maintenance incident subtype (refer to INM-30.2.1.1.1); II. list of lanes blocked (refer to INM-30.2.1.3); III. type of lanes blocked (refer to INM-30.2.1.4); o. road closure event: I. road closure subtype (refer to INM-30.2.1.1.1); II. number of lanes blocked; III. list of lanes blocked (refer to INM-30.2.1.3); IV. type of lanes blocked (refer to INM-30.2.1.4); p. special event information: I. special event subtype (refer to INM-30.2.1.1.1); II. event sponsor; q. electronic device outage: I. electronic device outage subtype (refer to INM-30.2.1.1.1); II. list of lanes blocked (refer to INM-30.2.1.3); III. type of lanes blocked (refer to INM-30.2.1.4); r. security incident: I. security incident subtype (refer to INM-30.2.1.1.1); II. threat level (severe, high, elevated, guarded, low); III. area affected (nation-wide, inter-state, state, regional, local).		
INM-30.5.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
INM-30.5.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
INM-30.5.3	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.7.3.2 Monitoring Incident Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-40	OR-IM-35, IR-GUI-16, UR-TO-1, OR-CMM-4	CapTOP shall allow the TMC Operator to retrieve and display the status of all active (all states except ended, deleted, cancelled, postponed, planned) incidents.	C	Demo
INM-40.1	IR-GUI-16, OR-IM-35, UR-TO-21	CapTOP shall allow the TMC Operator to retrieve, display, filter on, and sort on, any of the following fields which comprise the incident status window: a. incident ID; b. incident type (refer to INM-30.2.1.1); c. incident subtype (refer to INM-30.2.1.1.1); d. incident severity; e. incident status (refer to INM-30.2.1.10); f. incident location; g. source of incident; h. incident reported date; i. incident reported time; j. event start date; k. event start time.	C	Demo
INM-40.2	OR-SEPM-5	CapTOP shall provide the TMC Operator with a list of incidents, using the incident status window (refer to INM-40.1), that are active or planned to start in the next 4 hours, when they log into the system.	C	Demo
INM-40.3	OR-SEPM-5	CapTOP shall allow the user to select any incident in the incident status window and view all details pertaining to that incident.	C	Demo
INM-50	SR-SYS-2, IR-GUI-36, OR-IM-66, OR-SEPM-6, OR-CMM-4	CapTOP shall allow users to simultaneously view incident status, which is refreshed automatically by the system based on the refresh interval, using the following methods: a. Color coded icons on the map display that appear/disappear based on incident status (refer to INM-50.1); b. Via the Incident Management status window (refer to INM-40.1).	C	Demo

INM-50.1	IR-GUI-28, UR-TO-21, IR-GUI-56, IR-GUI-57	CapTOP shall use the following colors for incident icon types:
		a. orange = active construction/maintenance event;
		b. red = active traffic accident;
		c. blue = active special event;
		d. black = active road closure;
		e. gray = incident whose status is “ended” that will disappear after 30 minutes;
		f. white = active incident of all other types.
		Note: active is used to indicate all states except ended, deleted, cancelled, postponed, planned.
			C	Demo

INM-50.2	IR-GUI-29	The refresh rate for incident icon status (colors, icons appearing/disappearing) and for the data in the status window shall be configurable and based upon the refresh interval (refer to INM-70).	1	Demo
INM-60	SR-SYS-2,	CapTOP shall provide a menu option to search for an	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	IR-GUI-29, IR-GUI-31, IR-GUI-32, OR-IM-65, IR-GUI-40	incident by the following methods: a. incident ID; b. incident description; c. incident type (refer to INM-30.2.1.1); d. incident subtype (refer to INM-30.2.1.1.1); e. incident severity; f. incident status (refer to INM-30.2.1.10); g. incident location; h. incident reported date; i. incident reported time; j. incident end date; k. incident end time. l. event start date; m. event start time; n. keyword search using all fields.		
INM-60.1	IR-GUI-32, UR-TO-5	CapTOP shall allow the TMC Operator to search for incidents using a rubber-band style box on the map display to search an area.	C	Demo
INM-60.1.1	UR-TO-5	CapTOP shall allow the TMC Operator to select incidents, network segments, and ITS devices by boxing an area on the map display.	1	Demo
INM-60.1.2	UR-TO-6	CapTOP shall allow the TMC Operator to de-select incidents, network segments, and ITS devices by boxing an area on the map display.	1	Demo
INM-60.2	IR-GUI-32	The result of each search shall be a list of incidents that are sorted, by default, by incident reported date, incident reported time, and then incident status.	1	Demo
INM-60.3	IR-GUI-32	The result of each search shall be a list of incidents sortable by any of the following: a. incident ID; b. incident description; c. incident type (refer to INM-30.2.1.1); d. incident subtype (refer to INM-30.2.1.1.1); e. incident severity; f. incident status (refer to INM-30.2.1.10); g. incident location; h. incident reported date; i. incident reported time; j. incident end date; k. incident end time.	1	Demo
INM-70	OR-IM-4	CapTOP shall provide an interface through the CapTOP operations database for storing and retrieving incident data.	C	Demo
INM-70.1	OR-DOC-2, OR-DOC-3	CapTOP shall support a refresh rate interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
INM-70.2	IR-GUI-36	CapTOP shall be able to request incident status, obtain incident data, and refresh status windows through the interface with the CapTOP operations database.	1	Demo
INM-70.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to INM-40.1 for the list of fields) by hovering over an incident icon.	1	Demo
INM-80	OR-DWA-13,	CapTOP shall be able to store incident status and	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-IM-4	operational data (refer to INM-40) in the CapTOP operations database.		
INM-90	OR-IM-49	CapTOP shall provide the TMC Operator proper access rights to view contents of incident records currently active by another TMC operator with a "pass over" function to ensure pending items are addressed and critical information is passed on to next shift.	C	Demo

3.7.3.3 Incident Detection and Classification

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-100	OR-IM-1, SR-SYS-17, OR-CIP-3, OR-EM-8, OR-MMC-11, OR-MMC-12	CapTOP shall provide an interface to receive, log, and display incident alerts from the following external sources: a. CHART incident alerts; b. NOVA OpenTMS incident alerts; c. MWCOG incident alerts; d. RITIS electronic incident alerts; e. DDOT CIPS incident alerts; f. DDOT Snow Operation alerts; g. DC UCC alerts; h. DC Public Safety alerts; i. NCR Emergency Response alerts; j. WASA alerts; k. NAWAS alerts; l. 911/Netviewer electronic incident alerts (Netviewer is a product of Intergraph, Inc.); m. WMATA Metro Rail alerts via XML; n. Metro Bus alerts via XML; o. CVISN overweight alerts; p. Police amber alerts; q. ROP electronic incident alerts; r. Public Emergency Notification System s. DC Streetcar incident alerts; t. DC Tunnel Operations incident alerts.	a. 2 b. 2 c. 3 d. 1 e. 1 f. 1 g. 1 h. 1 i. 1 j. 3 k. 3 l. 1 m. 2 n. 1 o. 2 p. 1 q. 1 r. 1 s. 2 t. 2	Demo
INM-100.1	OR-IM-2	CapTOP shall be able to receive incident notifications from external sources and display them on the CapTOP map display, provided any of the following location information is provided: a. GPS longitude/latitude coordinates; b. A valid physical address; c. A valid intersection; d. A valid road name, direction and milepost or exit number;	1	Demo
INM-100.1.1	OR-IM-2	CapTOP shall be provide conversions for the following fields from their native values (as received from the external system) to the CapTOP values: a. Incident severity; b. Incident status; c. Incident type (refer to INM-30.2.1.1); d. Incident location;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		e. Incident subtype (refer to INM-30.2.1.1.1).		
INM-100.2	OR-IM-9	For incident notifications received electronically from remote systems, CapTOP shall pre-populate the following fields for the TMC Operator: a. incident status (refer to INM-30.2.1.10); b. incident type (refer to INM-30.2.1.1); c. incident subtype (refer to INM-30.2.1.1.1); d. detection time; e. road name; f. direction; g. source of detection.	1	Demo
INM-100.3	OR-IM-67	CapTOP shall provide a map-based display to show information from all other interfacing agencies through the use of colors, icons, and labels.	1	Demo
INM-100.4	OR-IM-68	CapTOP shall be able to track external agency incident response from all interfacing agencies providing incident data to support coordination of activities for all incidents.	1	Demo
INM-100.5	OR-SEPM-25, OR-MMC-10, OR-MMC-9	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.	3	Demo
INM-100.5.1	OR-MMC-9	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.	2	Demo
INM-100.5.2	OR-MMC-10	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.	2	Demo
INM-100.6	OR-SEPM-26, OR-MMC-10	CapTOP shall provide an interface with WMATA to receive information about bus ingress and egress routes during special events.	2	Demo
INM-100.7	UR-TO-15	CapTOP shall allow the TMC Operator to monitor the following types of alerts: a. 911/Netviewer alerts for traffic accidents; 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.	a. 1 b. 2 c. 2 d. 2 e. 1 f. 1	Demo
INM-100.8	UR-TO-16	CapTOP shall provide an interface with the National Warning System to share incident alerts in audio format.	3	Demo
INM-100.9	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.	1	Demo
INM-110	OR-IM-3, UR-TO-14	CapTOP shall allow the TMC Operator to enter and store incident information received via the following methods: a. viewing CCTV images;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		b. Citizen phone calls; c. ROP phone calls; d. MPD phone calls; e. police radio.		
INM-110.1	OR-IM-11	CapTOP shall allow the TMC operator to enter incidents from call-in reports involving the following non-DC agencies: a. WASA; b. Verizon; c. CSX; d. PEPCO.	3	Demo
INM-110.2	OR-IM-11	CapTOP shall provide an electronic call log for the TMC Operator to log all phone calls received and initiated.	3	Demo
INM-110.2.1	OR-IM-11	The call log shall have the following fields: a. TMC Operator Name; b. Date; c. Time; d. Call Received or Initiated; e. Person Contacted; f. Agency Contacted.	3	Demo
INM-120	OR-IM-12	CapTOP shall provide a common data structure for storing incident information regardless of the source of the information (refer to INM-30.2.1).	C	Inspect
INM-130	OR-IM-13	CapTOP shall identify cameras closest to the incident, where possible, and route video to a default display for TMC Operator viewing to confirm the incident.	C	Demo
INM-130.1	OR-IM-13	CapTOP shall automatically direct the camera to a preset that is in the direction of the incident.	C	Demo
INM-130.2	OR-IM-14, UR-TO-14	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 provide support in managing the incident.	C	Demo
INM-130.3	OR-IM-14, UR-TO-14	CapTOP shall accept the incident into the incident database only after confirmation that a camera close to the incident has been viewed, if one or more cameras are close to the incident location.	C	Demo
INM-140	OR-IM-15	CapTOP shall be able to classify incidents based on the incident location, incident type, incident subtype, and incident severity.	C	Demo
INM-140.1	OR-IM-15	CapTOP shall prompt the user to verify that he has accurately entered the location, incident type, incident subtype, and incident severity that is used to classify the incident.	1	Demo
INM-140.2	OR-IM-15	CapTOP shall accurately retrieve the appropriate incident response plan (or plans) based on the operator's classification (location, incident type, incident subtype, incident severity).	1	Demo

3.7.3.4 Managing Incident Response

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-150	OR-IM-16, UR-TO-14, UR-TO-1	CapTOP shall provide an event-driven incident response capability and have the ability to automatically retrieve the most appropriate incident response plan based on the user's incident classification (incident location, incident type, incident subtype, incident severity) from the CapTOP operations database.	C	Demo
INM-150.1	OR-IM-20	CapTOP shall be able to retrieve relevant incident response plans using lookups based on the type of incident, subtype of the incident, location, and severity.	C	Inspect, Analyze, Demo
INM-150.1.1	OR-IM-20	CapTOP shall have the option to also retrieve incident response plans based on knowledge-based, heuristic-based, and rule-based logic.	2	Inspect, Analyze, Demo
INM-150.2	OR-IM-17, OR-SEPM-18	CapTOP shall allow the TMC Operator to override CapTOP's choice for the most appropriate incident response plan and allow the operator to select any incident response plan from the library based on incident location, type and severity.	C	Demo
INM-160	OR-IM-18	Once an incident has been verified, location confirmed, and a type and severity assigned by the Operator, CapTOP shall prompt the operator with a pre-defined and step-by-step incident response plan.	C	Demo
INM-160.1	OR-IM-19	CapTOP shall provide the operator the ability to implement the incident response plan in its entirety, a portion of the incident response plan, or none of the incident response plan.	C	Demo
INM-160.2	OR-IM-21, OR-SEPM-15, IR-GUI-58, OR-DOC-21, OR-DOC-26, UR-TO-14, OR-DOC-34	The CapTOP incident response plan shall consist of the following: a. a list of HARs in close proximity to this incident and the suggested recording; b. a list of DMSs in close proximity to this incident and the suggested message; c. a list of PDMSs in close proximity to this incident and the suggested message; d. a list of signals effected by this incident and the recommended signal timing plans; e. notifications, with content and communication medium clearly defined, that needs to be transmitted to other agencies and stakeholders; f. alerts that should be generated; g. a list of CCTVs in close proximity to this incident and the suggested preset; h. a description of alternate route information; i. recommended ROP dispatches; j. graphical maps to illustrate traffic impacts; k. special event information: I. location of barriers/cones, tow trucks, and portable DMS; II. location of no parking areas;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		III. location of traffic control officers; IV. location of command vehicles and other special use vehicles; V. parking information; VI. recommended transit usage; l. hyperlinks to checklists, guidelines and procedural documents.		
INM-160.2.1	OR-IM-21, OR-SEPM-13	The CapTOP incident response plan shall provide an option that flashes the ITS device icons (CCTV, DMS, HAR, Signals) on the map display that are to be utilized as part of the incident response plan.	1	Demo
INM-160.2.1.1	OR-SEPM-22	CapTOP shall provide the TMC Operator a map-based display to identify the following devices that must be checked frequently during incidents: a. traffic signals; b. CCTV cameras; c. DMS; d. PDMS; e. HAR.	2	Demo
INM-160.2.2	OR-SEPM-2	CapTOP shall display the following special event information on the map display: a. road closures; b. routes impacted by the special event; c. parking restrictions; d. ITS device/signals used for the special events.	C	Demo
INM-160.2.3	OR-DOC-8	CapTOP shall maintain a library of pre-defined lists of devices required to support incident management that will be used by the TMC Manager in defining incident response plans.	C	Demo
INM-160.2.4	OR-SEPM-10	CapTOP shall disseminate traffic information during incidents to the public using the following methods: a. HAR; b. DMS; c. PDMS; d. Web.	1	Demo
INM-160.2.5	OR-SEPM-27	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 based on reported positions.	2	Demo
INM-160.2.6	OR-SEPM-28	CapTOP shall be able to retrieve and display up-to-date information about the location, communication status, and current message of PDMSs and DMSs operated by NOVA's OpenTMS and SHA's CHART systems that provide information for drivers destined for the city.	1	Demo
INM-160.2.7	UR-TO-22	CapTOP shall provide the TMC Manager the ability to share incident information with other agencies and jurisdictions.	1	Demo
INM-160.2.8	IR-GUI-36, IR-GUI-58	The CapTOP incident response plan shall provide an option that displays alternate route information on the map display that are to be utilized as part of the incident response plan.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-160.3	OR-IM-16	CapTOP shall be able to provide a .pdf link from the incident response plan to a procedural guidelines document for Scene Management that includes the following: a. Procedures for reporting incidents; b. Procedures for moving vehicles; c. Procedures for emergency traffic control; d. Procedures for use of emergency flashers; e. Parking and staging; f. Procedures for response teams; g. Procedures for use of response equipment.	1	Demo
INM-160.4	OR-IM-45	CapTOP shall incorporate SOP checklists in incident response plans and provide the TMC Operator electronic checklists that step through a prioritized list of needed actions as part of the incident response.	C	Demo
INM-160.4.1	OR-IM-22	CapTOP shall provide check boxes and comments to ensure each step is implemented, or alternatively to document why it was skipped.	1	Demo
INM-170	OR-IM-23, OR-IM-34, OR-TID-1	CapTOP shall provide a separate data structure for storing incident information that will be released outside of DDOT.	1	Demo
INM-170.1	OR-IM-23, OR-IM-34, OR-TID-1	CapTOP shall require the TMC Operator to filter incident data applicable for general public consumption and store in a separate data structure available for use for incident notifications, web dissemination, and other mechanisms used to disseminate information to the public.	1	Demo
INM-180	OR-IM-24, UR-TO-14, OR-DOC-34	CapTOP shall allow message notifications to be sent to PCs, cell phones, Blackberries, and PDAs.	1	Demo
INM-180.1	OR-IM-53, OR-TID-1, OR-CMM-6	CapTOP shall be able to disseminate the following details about incidents via notifications to specific groups using distribution lists, appropriate for each incident type and subtype: a. location; b. type of event; c. status of event; d. estimated duration of event (calculated from event start date/time and event end date/time); e. start time; f. end time.	1	Demo
INM-180.1.1	OR-IM-25	CapTOP shall allow the TMC Operator to disseminate notifications to the public, which contain the details, but without sensitive personal information, of each incident.	1	Demo
INM-180.1.2	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;	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		d. unplanned construction- road, lanes, start/end date and times.		
INM-180.2	OR-IM-26	CapTOP shall provide the TMC Operator the ability to disseminate incident information to the media and the press.	1	Demo
INM-180.3	OR-IM-27	CapTOP shall be able to generate and send incident notifications 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. web alerts.	1	Demo
INM-180.4	OR-IM-28, OR-IM-51	CapTOP shall be able to send incident notifications to various stakeholders based on location, road type, time of day, severity, and type.	1	Demo
INM-180.5	OR-IM-29, OR-TID-1	CapTOP shall maintain "notification" distribution list(s) of stakeholders for each type/subtype of incident.	1	Demo
INM-180.6	OR-IM-29, OR-TID-1	CapTOP shall send electronic notifications during incidents when there is a change in incident status.	1	Demo
INM-180.6.1	OR-IM-30	CapTOP shall be able to send notifications to individuals and distribution lists via the Alert DC System.	1	Demo
INM-180.7	OR-IM-33	CapTOP shall be able to confirm receipt of outgoing alerts and notifications sent electronically to specific distribution lists.	1	Demo
INM-180.8	OR-IM-23, OR-IM-34, OR-TID-1	CapTOP shall provide online templates for creating and storing text message notifications for different types of incidents for dissemination to subscribers (subscriber = any user with an email or SMS address).	1	Demo
INM-180.9	OR-IM-23, OR-IM-34	CapTOP shall provide online templates for creating and storing text message alerts for different types of incidents for dissemination to CapTOP users logged into the system.	1	Demo
INM-190	OR-IM-40, OR-IM-41, OR-SEPM-1, OR-DOC-29, OR-CMM-3	CapTOP shall provide the TMC Operator and TMC Manager with alerts/reminders to take action on DDOT incidents (not external incidents) at the following times: a. start of incident; b. expected duration of incident exceeded; c. after a pre-configured amount of time has expired if no updates have occurred to active (all states except ended, deleted, cancelled, postponed, planned) incidents; d. for road closures at the scheduled tear-down time.	C	Demo
INM-190.1	OR-SEPM-20	CapTOP shall provide reminders to TMC Operators and TMC Managers for active (all states except ended, deleted, cancelled, postponed, planned) traffic accidents and electronic device outages (traffic signal outage and power) that have had no activity for X minutes, where X is variable based on incident	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		severity: a. minor (default is 15 minutes); b. major (default is 15 minutes); c. regional (default is 15 minutes).		
INM-190.1.1	OR-SEPM-20	CapTOP shall provide the ability for the System Administrator to configure the reminder times using a separate parameter for minor incidents, major incidents, and regional incidents.	1	Demo
INM-190.1.2	OR-SEPM-20	For the purpose of determining when to initiation reminders, CapTOP shall determine the period with no activity by comparing the last update date/time field stored with each incident with the current time.	1	Demo
INM-190.2	OR-SEPM-21	CapTOP shall provide incident response plan reminders to TMC Operators and TMC Managers at a configurable number of minutes prior to a preplanned event start.	C	Demo
INM-190.3	OR-IM-47	CapTOP shall provide alerts to TMC Operators and TMC Managers when incident records have remained active for a specified period of time.	C	Demo
INM-190.4	UR-TO-11, OR-IM-23	CapTOP shall be capable of generating a system alert for new incidents for designated incident types, subtypes, and designated severities.	C	Demo
INM-190.5	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	Demo
INM-190.5.1	UR-TO-18	CapTOP shall provide the TMC Manager the capability to document outcomes of traffic management schemes, using the CapTOP operations and log databases.	1	Demo
INM-200	OR-IM-36	CapTOP shall be able to track an operator's activities, track the status of available personnel and equipment resources, and track follow-ups that are needed during incidents.	1	Demo
INM-200.1	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	Demo
INM-200.2	OR-SEPM-24	CapTOP shall be able to store and retrieve staffing assignments, and point of contact lists for planned special events.	1	Demo
INM-210	OR-IM-42	CapTOP shall prevent users at different workstations from working on (updating status, responding) the same incident in the system, at the same time.	1	Demo
INM-210.1	OR-IM-42	The above requirement should not prevent any operator from viewing incident status at any time (refer to INM-50).	1	Demo
INM-220	OR-IM-44	CapTOP shall support an interactive development process for incident response plans with TMC managers, permitting editing, reviewing, and baselining of each plan.	1	Demo
INM-230	OR-IM-48	CapTOP shall allow the TMC Manager to reassign incidents to other operators for any reason.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-230.1	OR-IM-48	CapTOP shall prompt the TMC Operator to reassign current active (all incidents except ended, deleted, cancelled, postponed, planned) incidents assigned to him/her during logout.	C	Demo
INM-230.1.1	OR-IM-48	The reassigning user shall be prompted with only a list of users currently logged in.	1	Demo
INM-230.1.2	OR-IM-48	The newly assigned user shall be required to accept confirmation of the reassignment incident prior to the primary user be permitted to logout.	C	Demo
INM-230.1.2.1	OR-IM-48	The reassigned incident shall be logged on the TMC Manager's workstation using a pop-up alert.	1	Demo
INM-240	OR-IM-50	CapTOP shall provide the TMC Operator access to the following resources: a. contact lists; b. incident response plans; c. SOPs; d. help functions.	C	Demo
INM-250	OR-IM-51	CapTOP shall maintain a stakeholder contact list in the operations database that can identify Points of Contact (POCs) for all agencies/organizations involved in traffic incident management and response.	C	Demo
INM-250.1	OR-IM-52	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.	C	Demo
INM-260	OR-SEPM-16	CapTOP shall maintain a comprehensive Point of Contact (POC) list for each special event that identifies the organizers, contacts at event venue, and individuals in various DC agencies.	C	Demo
INM-260.1	OR-SEPM-17	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; g. POC cell phone number.	C	Demo
INM-270	OR-IM-55	CapTOP shall be able to identify and prompt the Operator for the removal of duplicate incident records.	1	Demo
INM-270.1	OR-IM-55	CapTOP shall be able to identify duplicate incident records, if a new incident of the same type is created within X feet of the primary incident location, where X defaults to 100 feet, and where X is configurable by the System Administrator.	1	Demo
INM-280	OR-IM-56, OR-DOC-29	CapTOP shall be able to prompt the Operator to reset ITS devices to their pre-incident status when closing an incident.	1	Demo
INM-280.1	OR-IM-57, OR-SEPM-15	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 PDMS; d. restoring a default message to a PDMS;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		e. blanking a HAR; f. restoring a default message to a HAR; g. returning cameras to their default position/preset.		
INM-290	OR-IM-69	CapTOP shall provide a map-based display to show the schedule and status of reversible lanes for monitoring and control purposes during incidents.	C	Demo
INM-300	OR-IM-70	CapTOP shall support Police Amber alerts by permitting Amber alert messages to be displayed on the following: a. DMS; b. PDMS.	1	Demo
INM-310	OR-IM-71	CapTOP shall support Police Amber alerts by permitting Amber alert messages to be recorded on HAR devices.	1	Demo

3.7.3.5 Incident Management Scheduler

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-320	OR-SEPM-1, OR-DOC-30, OR-DOC-29	CapTOP shall be able to define and schedule the following event types using a schedule editor: a. Weather event; b. Construction event; c. Emergency Road closure event; d. Special event; e. Maintenance repair event; f. Other.	C	Demo
INM-320.1	OR-DOC-22, OR-DOC-30	The CapTOP schedule capability shall permit time of day recurring and non-recurring entries for designated event types.	C	Demo
INM-320.2	OR-DOC-22, OR-DOC-30	The schedule shall permit a non-recurring, one-time only event to be scheduled, where the user specifies a schedule name, event name, reminder date/time, event start date, event start time, event end date, and event end time.	C	Demo
INM-320.3	OR-DOC-22, OR-DOC-30	CapTOP shall provide a recurring schedule capability and permit any of the following recurring entry types: a. Weekdays – Monday through Friday; b. Weekends – Saturday and Sunday only; c. All Days – Monday through Sunday; d. One day or any combination of days per week; e. One day or any combination of days per month.	C	Demo
INM-320.3.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow recurring schedule entries to be created for designated events, where the user specifies a schedule name, event name, recurring entry type, reminder date/time, event start date, event start time, event end date, and event end time (event end date/time optional).	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-320.3.2	OR-DOC-22, OR-DOC-30	CapTOP shall permit an optional event end date to be specified for all recurring schedule entries.	1	Demo
INM-320.3.2.1	OR-DOC-22, OR-DOC-30	CapTOP shall implement the recurring scheduling indefinitely if no event end date is specified.	1	Demo
INM-320.3.3	OR-DOC-22, OR-DOC-30	CapTOP shall allow a Holiday schedule to be specified for the CapTOP system.	1	Demo
INM-320.3.3.1	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to indicate whether each Holiday is treated as an exception to the recurring schedule.	1	Demo
INM-320.3.3.2	OR-DOC-22, OR-DOC-30	CapTOP shall allow the user to specify each Holiday exception to be treated as either a Weekend or Weekday whenever encountered.	1	Demo
INM-330	OR-DOC-22, OR-DOC-30	CapTOP shall allow the TMC Operator to edit and delete scheduled entries.	1	Demo

3.7.3.6 Incident Management Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-340	OR-DOC-22, OR-DOC-30, IR-GUI-57	CapTOP shall allow the TMC Operator to produce a report of all scheduled entries for any of the following: a. individual special event; b. individual road closure events; c. individual electronic device outage event; d. individual construction/maintenance event; e. all special events; f. all road closures; g. all electronic device outages; h. all construction/maintenance events.	C	Demo
INM-340.1	OR-DOC-22, OR-DOC-30	The report shall list all schedule entries, and shall contain the following: a. schedule name; b. event name; c. recurrent entry type (optional); d. event start date; e. event start time; f. event end date (optional); g. event end time (optional); h. incident type (refer to INM-30.2.1.1); i. incident subtype (refer to INM-30.2.1.1.1); j. incident severity; k. incident status (refer to INM-30.2.1.10); l. incident location; m. source of incident.	C	Demo
INM-350	SR-SYS-22, SR-SYS-36, IR-GUI-8	CapTOP shall be able to generate real-time tabular reports that show the status of all incidents at the TMC Operator's request.	C	Demo
INM-350.1	SR-SYS-22, SR-SYS-36, IR-GUI-8, OR-IM-46,	CapTOP shall query, retrieve, display, and be able to filter on, and sort on any the following information in the incident status report: a. incident ID;	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-IM-58	b. incident type (refer to INM-30.2.1.1); c. incident subtype (refer to INM-30.2.1.1.1); d. incident severity; e. incident status (refer to INM-30.2.1.10); f. incident location; g. source of incident; h. incident reported date; i. incident reported time; j. incident end date; k. incident end time; l. event start date; m. event start time; n. event end date; o. event end time.		
INM-350.2	OR-TDCA-19	CapTOP shall collect and format traffic and incident data for direct use in DDOT's current traffic simulation/analysis application (currently Synchro).	2	Demo
INM-360	OR-PM-3, OR-PM-4, OR-SEPM-14, SR-SYS-22, UR-TO-20	CapTOP shall be able to create performance reports related to incident management.	2	Demo
INM-360.1	OR-PM-4, OR-SEPM-14, SR-SYS-22, UR-TO-20	CapTOP shall be able to create a separate performance report for any incident with the following incident information, using data in the CapTOP operations, log, and archived databases: a. incident ID; b. incident type; c. incident subtype; d. incident location; e. incident severity; f. timeline of all system activities related to an incident; g. messages to DMS/PDMS; h. messages to HAR; i. call logs; j. operator notes; k. incident response times; l. incident durations based on type; m. changes to incident status; n. alerts and notifications sent to other systems. o. alerts and notifications received by other systems. p. special event information: I. number of attendees; II. event duration; III. traffic impacts;	2	Demo
INM-360.1.1	OR-PM-4, OR-SEPM-14, SR-SYS-22, UR-TO-20	CapTOP shall provide graphical displays to show a visual timeline of the evolution of the incident through various incident states (from beginning to end).	2	Demo
INM-360.2	OR-DWA-4, OR-SEPM-3, OR-SEPM-8	CapTOP shall be able to produce the following performance reports, useful for FHWA incident management performance reporting and system	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		performance evaluation, based on operations and archived data: a. number of incidents over a specified time period; b. number of incidents of a certain type/subtype over a specified time period; c. list of incidents of a certain type/subtype over a specified time period; d. number of device malfunctions over a specified time period; e. average duration of all incidents over a specified time period; f. average duration of incidents of a certain type/subtype over a specified time period; g. average number of ROPs for all incidents over a specified time period; h. average number of ROPS for incidents of a certain type/subtype over a specified time period; i. average elapsed time from incident reported time to incident confirmation; j. average elapsed time from incident occurrence to incident response; k. number of ROP assists over a specified time period; l. average number of DMS used for all incidents over a specified time period; m. average number of DMS used for incidents of a certain type/subtype over a specified time period; n. average number of PDMS used for all incidents over a specified time period; o. average number of PDMS used for incidents of a certain type/subtype over a specified time period; p. number of ROPs required per incident; q. number of ROPS required per special event; r. number of DMS required per incident; s. number of DMS required per special event; t. number of PDMS required per incident; u. number of PDMS required per special event; v. number of times different agencies responded to incidents; w. type and average quantity of field equipment used for all incidents over a specified time period; x. type and average quantity of field equipment used for incidents of a certain type/subtype over a specified time period; y. average number of DDOT field technicians used for all incidents over a specified time period; z. average number of DDOT field technicians used for incidents of a certain type/subtype		

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		over a specified time period; aa. average number of DDOT staff hours used for all incidents over a specified time period; bb. average number of DDOT staff hours used for incidents of a certain type/subtype over a specified time period; cc. average number of attendees at special events over a specified time period; dd. average number of attendees at a special event subtype over a specified time period; ee. average number of transit riders at special events over a specified time period; ff. average number of cones used for traffic management for all incidents over a specified time period; gg. average number of cones used for traffic management incidents of a certain type/subtype; hh. number of DDOT field technicians used for each incident; ii. number of DDOT field technicians used for each special event; jj. number of DDOT staff hours used for each incident; kk. number of DDOT staff hours used for each special event; ll. number of attendees at each special event ; mm. number of transit riders at each special event (if available, estimate only); nn. number of cones used for traffic management at each special event.		
INM-360.3	OR-ROP-4, OR-ROP-5	CapTOP shall provide ROP performance reports to that report the following over a user-specified time interval: a. status/availability of ROP vehicles; b. number of drivers per shift; c. resources consumed; d. expenditures; e. number of ROP unit assists.	2	Demo
INM-370	OR-PM-5	CapTOP shall produce post-event reports that document the resources used.	2	Demo
INM-370.1	OR-SEPM-3	CapTOP shall provide DDOT staff with functions to track personnel activities associated with supporting special events.	1	Demo
INM-370.1.1	OR-SEPM-3	The information shall be able to be viewed on the workstation and printed in the form of a report.	2	Demo
INM-370.2	OR-SEPM-3	CapTOP shall provide DDOT staff with functions to view data and generate reports related to personnel activities and costs associated with supporting special events.	2	Demo
INM-380	SR-SYS-22, SR-SYS-36, IR-GUI-8,	CapTOP shall be able to display and print the following reports: a. For a user specified incident, provide a	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	SR-SYS-25	detailed report of all information in the database pertaining to that incident (refer to INM-30.2.1). b. For a user specified time-interval, provide a list of all incidents with the following fields: I. incident ID; II. incident type (refer to INM-30.2.1.1); III. incident subtype (refer to INM-30.2.1.1.1); IV. incident severity; V. incident status (refer to INM-30.2.1.10); VI. incident location; VII. incident reported date; VIII. incident reported time; IX. incident end date; X. incident end time; XI. event start date; XII. event start time; XIII. event end date; XIV. event end time. c. An ad-hoc report where the user can query any data stored in incident related databases; d. For a user specified time-interval and for a given User ID, provide a list of all incidents with the following fields: I. incident ID; II. incident type (refer to INM-30.2.1.1); III. incident subtype (refer to INM-30.2.1.1.1); IV. incident severity; V. incident status (refer to INM-30.2.1.10); VI. incident location; VII. incident reported date; VIII. incident reported time; IX. incident end date; X. incident end time; XI. event start date; XII. event start time; XIII. event end date; XIV. event end time. e. For a user specified time-interval, provide a work-zone report that shows the road name, direction, closure information, and date and time last updated.		
INM-390	OR-IM-37, UR-TO-14	CapTOP shall be able to process and organize incident 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.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-390.1	OR-DOC-9, SR-SYS-27	CapTOP shall provide a report capability to retrieve all operator actions/commands from the log that are part of an incident response.	2	Demo
INM-390.2	IR-GUI-8	CapTOP shall provide tabular reports for the following: a. Current active (all states except ended, deleted, cancelled, postponed, planned) incidents, selectable by type/subtype, sortable by location, incident reported date, and incident reported time; b. Historical incidents, selectable by type/subtype, sortable by location, incident reported date, and incident reported time. Note: if type is special event, road closure event, construction/maintenance event, or electronic device outage event, in lieu of incident reported date/time, use event date date/time.	2	Demo
INM-400	OR-IM-38	CapTOP shall provide the TMC operator the ability to generate incident reports and activity reports describing the characteristics and status of all incidents addressed during each operations shift.	2	Demo
INM-410	OR-IM-39	CapTOP shall be able to generate incident reports, by type, tailored to the needs of the following stakeholders: a. elected officials; b. supervisors; c. senior management.	2	Analyze
INM-420	SR-SYS-22, SR-SYS-36, IR-GUI-8	CapTOP shall support the following capabilities for all reports: a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format. c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	a. 2 b. 2 c. 2 d. 2 e. 2 f. 2	Demo

3.7.3.7 Incident Management Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-430	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to incidents and provide the output in a time sequential log.	C	Demo
INM-430.1	UR-TO-11,	CapTOP shall have the capability to automatically log	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-C2F-3, OR-C2F-4, OR-DWA-13, SR-SYS-27	the following user activities to the log database that pertain to incidents: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to an incident; c. user actions that are part of incident response; d. operator login; e. operator logout. (Note: also refer to the LOG-* requirements).		
INM-430.1.1	OR-IM-59, OR-SEPM-7, SR-SYS-27, UR-TO-11	CapTOP shall provide the ability to log the following information needed to support a comprehensive log of activities for each event/incident in the system: a. commands entered by the TMC Operator, including operator name, date, and time; b. command description; c. phone calls made; d. incident detection source; e. incident updates – to any fields; f. confirmation time; g. clearance time; h. resources used/dispatched; i. other agencies notified; j. control actions to DMS; k. control actions to PDMS; l. control actions to HAR; m. control actions to Traffic Signals; n. incident response plan actions; o. any messages/notifications received or sent to external organizations.	C	Demo
INM-430.1.2	OR-IM-31, SR-SYS-27	CapTOP shall log all TMC Operator transmitted notifications and alerts.	C	Demo
INM-430.1.2.1	OR-IM-32	The CapTOP log shall identify the date, time, operator who generated the alert or notification, and message content.	C	Demo
INM-430.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to incidents: a. any system-initiated action that attempts to, or results in, a change to an incident; b. software application login; c. software application logout; d. software application errors; e. database login; f. database logout. (Note: also refer to the LOG-* requirements).	C	Demo
INM-430.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for incidents.	1	Demo
INM-430.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all Incident Management activities: a. operator input; b. operator incident response;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.		
INM-430.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the incident ID, description of action, and summary incident status).	1	Demo
INM-430.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
INM-430.7	OR-IM-60	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	C	Demo
INM-440	OR-DWA-5, SR-SYS-27	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to incidents from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.	1	Demo

3.7.3.8 Incident Management Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-450	OR-IM-43, OR-SEPM-4	CapTOP shall archive all incident data to develop, evaluate, and refine strategies, and scenarios for different types of events/incidents under different conditions.	1	Demo
INM-460	OR-IM-43, OR-SEPM-4	CapTOP or related third party tools shall have the capability to format and perform automated and manually initiated migration of logged data that pertains to incidents from the log database to the archived database.	1	Demo
INM-470	OR-IM-43,	CapTOP or related third party tools shall have the	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-SEPM-4	capability to format and perform automated and manually initiated migration of operations data that pertains to incidents from the operations database to the archived database.		
INM-480	OR-SEPM-4	CapTOP shall archive the following information related to special events: a. operator actions during special events; b. incident response plans for special events.	1	Demo

3.7.3.9 Incident Management ROP, MPD, and Snow Center Support Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-490	OR-IM-62, UR-TO-27	CapTOP shall support incident response coordination between the TMC and the ROP drivers through real-time information exchange.	2	Demo
INM-490.1	OR-IM-61, UR-TO-26, UR-TO-27	CapTOP shall provide ROP drivers a remote web-based interface to CapTOP to perform the following: a. view incident status (refer to INM-30.2.1.10); b. receive incident notifications; c. receive incident response requests; d. view device status; e. view event logs; f. view live video; g. view incident response plans to understand required field actions; h. enter incident information from incident scenes.	2	Demo
INM-490.1.1	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.	2	Demo
INM-490.2	OR-ROP-1, OR-PM-8	CapTOP shall provide a ROP-specific log, unique to each driver, to store the following ROP driver activities: a. ROP vehicle ID/number; b. ROP driver name; c. starting location; d. ending location; e. miles traveled; f. type of incidents responded to; g. time spent at incident.	2	Demo
INM-490.2.1	OR-PM-10	CapTOP shall have the capability to retrieve the ROP driver activity report by specifying the ROP name and date from the operations database.	2	Demo
INM-490.2.2	OR-PM-9	CapTOP shall provide a function to retrieve the ROP driver activity log by date/time.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-490.3	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. logging ROP responses in the CapTOP incident database.	2	Demo
INM-490.4	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.	3	Demo
INM-490.5	OR-ROP-3	CapTOP shall provide a map-based display to show the location and assignment status of ROP resources.	2	Demo
INM-500	OR-IM-63	CapTOP shall provide an interface to receive and display mobile video images from wireless portable CCTV cameras used by ROP operators.	2	Demo
INM-510	OR-IM-64	CapTOP shall be able to track and display the current location of AVL-equipped ROP vehicles at all times that a ROP location report is available within the last parameter (default value of 5 minutes) time period.	2	Demo
INM-520	OR-SEPM-12	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.	3	Demo
INM-530	IR-GUI-43	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	Demo
INM-540	UR-TO-31, OR-CMM-4	CapTOP shall provide remote TMC Operators, not connected to the DDOT network, the ability to view the following through the web, subject to username/password and privilege level: a. traffic condition information; b. video; c. roadway weather information; d. regional weather information; e. incident information; f. ITS device status.	1	Demo
INM-540.1	OR-SEPM-11	CapTOP shall provide a web-based interface to allow TMC Operators or authorized Guests, at remote locations, to access the following details about incidents subject to username/password and privilege	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		level: a. incident ID; b. incident description; c. incident type (refer to INM-30.2.1.1); d. incident subtype (refer to INM-30.2.1.1.1); e. incident severity; f. incident status (refer to INM-30.2.1.10); g. incident location; h. incident reported date; i. incident reported time; j. incident end date; k. incident end time; l. event start date; m. event start time; n. event end date; o. event end time; p. DMS/HAR messages; q. incident response plan name.		
INM-540.2	OR-SEPM-11	CapTOP shall provide a web-based interface to allow TMC Operators or authorized Guests, at remote locations to view CapTOP's live video from any camera.	1	Demo
INM-550	UR-TO-32	CapTOP shall provide remote users, connecting via the District's existing VPN and using the secure token ID system, the ability to update incident information and control ITS devices, subject to user privileges.	1	Demo
INM-560	UR-TO-31, OR-CMM-4	CapTOP shall provide remote users (not TMC Operators), not connected to the DDOT network, the ability to view the following through the web, subject to username/password and privilege level: a. traffic condition information; b. video; c. roadway weather information; d. regional weather information; e. current DMS messages; f. current HAR messages; g. incident information.	1	Demo

3.7.3.10 Response Plan Editor

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-570	OR-IM-45	CapTOP shall provide the TMC Manager the ability to build, in an offline environment, an incident response plan to be used with incident management.	C	Demo
INM-570.1	OR-IM-45	Each incident response plan shall be required to be stored with the following attributes: a. location; b. incident type; c. incident subtype; d. severity.	C	Demo
INM-570.2	OR-IM-45	Each incident response plan shall have a unique name.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
INM-580	OR-IM-45	CapTOP shall provide an editor to build the following information into each incident response plan: a. a list of HARs in close proximity to this incident and the suggested recording; b. a list of DMSs in close proximity to this incident and the suggested message; c. a list of PDMSs in close proximity to this incident and the suggested message; d. a list of signals effected by this incident and the recommended signal timing plans; e. notifications, with content and communication medium clearly defined, that needs to be transmitted to other agencies and stakeholders; f. alerts that should be generated; g. a list of CCTVs in close proximity to this incident and the suggested preset; h. a description of alternate route information; i. recommended ROP dispatches; j. graphical maps to illustrate traffic impacts; k. special event information: I. location of barriers/cones, tow trucks, and portable DMS; II. location of no parking areas; III. location of traffic control officers; IV. location of command vehicles and other special use vehicles; V. parking information; VI. recommended transit usage; l. hyperlinks to checklists, guidelines and procedural documents.	C	Demo
INM-580.1	OR-IM-45	CapTOP shall verify the location of each PDMS included in an incident response plan to confirm that the display of the planned message is appropriate for the current position of the PDMS.	1	Demo
INM-590	OR-IM-45	CapTOP shall have an incident response plan library in the central system with the following capabilities: a. be capable of storing a minimum of 1,000 incident response plans; b. be capable of having a name associated with the library; c. allow users to create, delete and edit incident response plans within the library, in accordance with user privileges; d. allow users to rename incident response plans; e. be capable of searching for incident response plans in the library using a keyword or phrase; f. allow the users to search for incident response plans in the library by the following methods: I. by incident response plan name; II. by location; III. by incident type;	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		IV. by incident subtype; V. by severity; VI. by date created; VII. by date modified; VIII. by username you last modified; IX. by any combination of the above. g. allow users to copy incident response plans, edit as required, and save as a new name; h. allow the TMC Operator to delete incident response plans, one at a time, in accordance with user privileges; i. allow the TMC Operator to delete all incident response plans in one command in accordance with user privileges; j. allow the TMC Operator to select multiple incident response plans and delete them in one command, in accordance with user privileges; k. allow the incident response plan to be viewed on the screen or printed; l. be able to display the date and time the incident response plan was created; m. be able to display the username that created the incident response plan; n. be able to display the date and time the incident response plan was last modified; o. be able to display the user name that last modified the incident response plan.		
INM-600	OR-IM-45	CapTOP shall configuration manage using version control each incident response plan.	1	Demo
INM-600.1	OR-IM-45	CapTOP shall be able to track differences between versions of each incident response plan.	1	Demo
INM-600.2	OR-IM-45	CapTOP shall be able to store the reason for change and the user name associated with each version.	1	Demo
INM-600.3	OR-IM-45	CapTOP shall be able to restrict more than 1 user from editing a particular incident response plan at the same time.	1	Demo

3.7.4 Emergency Management/Evacuation Requirements

CapTOP's emergency management/evacuation functional requirements are addressed in various sections. Refer to the following requirements:

- GUI-120.1.2;
- SIG-20;
- SIG-40*;
- SIG-110;
- SIG-120.

In addition, CapTOP shall meet the requirements below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
EME-10	OR-DOC-35	CapTOP shall support centralized HAR, DMS, and PDMS control for coordinating regional emergency evacuation.	2	Demo
EME-20	OR-EM-9	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	Demo
EME-30	IR-GUI-47	CapTOP shall provide the TMC Operator a map-based display to monitor the following operations on roadways during normal operations, evacuations, special events, and during incidents: a. configuration of reversible lane facilities; b. one-way streets; c. blank-out-signs; d. red X and green arrow lane control signals; e. lane/turning restrictions; f. signal status. Also refer to requirements (SIG-20, SIG-40*, SIG-110, and SIG-120).	a. 1 b. 1 c. 2 d. 2 e. 1 f. 1	Demo

Also, refer to the Incident Management section **Error! Reference source not found.**. The Incident Management section is relevant to evacuation management, since evacuations can be managed as a special event using an automated response plan.

3.7.5 Traveler Information Requirements

3.7.5.1 Travel Time

CapTOP's travel time functional requirements are addressed in various sections. Refer to the following requirements:

- SYS-80.1;
- DB-20.1;
- GDB-50;
- ODB-20;
- DBR-50;
- GUI-170;
- GUI-250.2;
- DMS-150;
- DMS-290;
- RTC-40.

3.7.5.2 Web-Based Traveler's Information

DDOT's Web interface requirements are addressed in the section **Error! Reference source not found. Error! Reference source not found.**. Note: additional Web Interface requirements can be found in this document by performing a "find" and searching for "web-based".

3.7.5.3 Congestion and Traffic Condition Monitoring

CapTOP's congestion and traffic condition monitoring functional requirements are addressed in various sections. Refer to the following requirements:

- CGA-10*;
- DBA-20.1;
- DWA-40;
- DWA-40;
- GDB-50;
- GDB-50;
- GUI-120.1 and GUI-120.1.1;
- GUI-150*;
- GUI-250.2 and 250.3;
- GUI-260.1;
- INM-530, 540, 560;
- ODB-20;
- PCS-50.1;
- RTC-10;
- RTC-20;
- SPD-50.1;
- SYS170;
- SYS-200;
- SYS-80.1;
- TDA-10;
- TDC-50.1;
- TDS-50.1.

3.7.5.4 Special Event Management

The majority of CapTOP's special event management requirements are captured in the Incident Management Section **Error! Reference source not found.**. Refer to requirements INM-*. In addition, refer to the requirements below which are also relevant to special event management:

- SYS-140;
- DBR-40;
- GUI-120.1.1;
- GUI-250.4;
- GUI-350.2;
- CCT-250.1;
- DMS-130.1;
- HAR-130.1

3.7.5.5 Incident Management

CapTOP's incident management requirements are captured in the Incident Management Section **Error! Reference source not found.**. Refer to requirements INM-*. In addition, in numerous

other sections incident management requirements are described. These requirements can be found in this document by performing a "find" and searching for "incident".

3.7.5.6 Dissemination Partners

The CapTOP system is designed to support information dissemination and sharing with government agencies and private companies, including web-based traffic companies, regional information clearing houses, and local, count, state, and federal governments. This is accomplished through the use of center-to-center information sharing interfaces.

Refer to section **Error! Reference source not found. Error! Reference source not found.** for additional information.

3.8 Interfaces to Other Systems/Applications within DDOT

3.8.1 CVISN/WIM Interface Requirements

CapTOP's CVISN/WIM interface requirements are addressed in various sections. Refer to the following requirements:

- INM-100;
- INM-100.7;
- SYS-150.2;
- SYS-160;
- SYS-180;
- CDB-10.1;
- ODB-10.1;
- DBR-70;
- DBR-110
- TDA-10.1.

CapTOP shall also support the CVISN interface through the standard CapTOP Web-Interface available for remote users. In addition, CapTOP shall meet the requirements below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
CVN-10	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	Demo
CVN-20	OR-CVSN-2	CapTOP shall be able to send MPD and other agencies alerts and notifications when a HAZMAT vehicle is encountered.	2	Demo
CVN-30	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	Demo
CVN-40	OR-CVSN-4	CapTOP shall be able to access and display truck routes with weight restrictions on the CapTOP map display.	2	Demo
CVN-50	OR-CVSN-5,	CapTOP shall provide an interface with CVISN's	2 overall,	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-GUI-14, OR-C2F-3, OR-C2F-4, OR-DOC-1, SR-SYS-23	Roadside Operations Computers (ROCs) to access the following CVISN information: a. video; b. vehicle data (speed, volume, classification and weight); c. overweight vehicle alarms (weigh-in-motion data); d. WIM station status (OK, failed); e. messages displayed on CVISN's DMS signs; f. AVI data for monitoring movement at the TMC for HAZMAT movements and oversized/special permit vehicle movements.	3 for item e	
CVN-60	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	Demo
CVN-70	OR-CVSN-7, OR-RTC-13	CapTOP shall provide an interface with the CVISN E-Screening Program to access WIM information, store in the CapTOP operations database, and report on real-time overweight trucks.	2	Demo
CVN-80	OR-CVSN-8	CapTOP shall be able to access and display truck routes with height restrictions on the CapTOP map display.	2	Demo
CVN-90	OR-CVSN-9	CapTOP shall provide the following pre-trip incident information to the CVO truckers and dispatchers delivered via the Internet: i. the following incident information along truck routes: 1. accidents; 2. congestion; 3. construction activities; 4. special events; 5. road closures. j. information on alternate routes in the event of major incidents and special events; k. special events that may affect truck routes; l. maximum vehicle heights at low bridges/underpasses; m. weight restrictions displayed by road/location.	3	Demo
CVN-100	OR-CVSN-10	A CapTOP workstation shall be available at the CVISN scale house to provide access to the following general information: d. incidents; e. congested areas; f. special events; g. signal status; h. ITS device status; i. live video; j. road closures; k. lane closures; l. construction zones; m. maintenance operations; n. traffic condition data; o. weather-related road conditions; p. weather-related warnings;	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		q. weather-related closures.		
CVN-110	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	Demo
CVN-120	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	Demo
CVN-130	OR-CVSN-7, OR-DOC-4, OR-DWA-4, SR-SYS-36	CapTOP shall provide an interface with the CVISN Roadside Operations Computer to access WIM information to provide a report, based on a user-specified timer interval, with the following information, subject to user privileges: a. date of report; b. time of report; c. WIM Station ID; d. vehicle ID; e. vehicle type; f. allowed weight; g. actual weight; h. date of weight reading; i. time of weight reading.	2	Demo
CVN-140	UR-TO-25, OR-DOC-4, SR-SYS-36	CapTOP shall provide the ability to provide a real-time WIM status report with the following information: a. WIM Station ID; b. WIM location; c. WIM online/offline mode; d. WIM status (OK, failed); e. date of last reading; f. time of last reading.	2	Demo
CVN-140.1	UR-TO-25, OR-DOC-4, SR-SYS-36	CapTOP shall provide a monitoring interface to the existing CVISN Roadside Operations Computer through CapTOP's new traffic data server. Refer to TDA-10* for more information.	2	Demo
CVN-140.2	UR-TO-25, OR-DOC-4,	CapTOP's Traffic Data Server (developed by others, or optionally, by the CapTOP developer) shall	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	SR-SYS-36	interface with CVISN Roadside Operations Computer to obtain real-time WIM data.		
CVN-150	IR-GUI-26	CapTOP shall provide map-based displays that display color-coded icons to reflect the real-time status for the WIM stations.	2	Demo
CVN-150.1	IR-GUI-26	The icon color shall be green if the WIM station is online with no overweight vehicles in the last 1 minute, gray if the WIM is offline, and red if the WIM has had an overweight vehicle in the last 1 minute.	2	Demo
CVN-150.2	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the CVISN Roadside Operations Computer; b. data gained by CapTOP in attempts to communicate with the CVISN Roadside Operations Computer; c. online/offline information entered manually by authorized CapTOP users.	2	Demo
CVN-160	OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following WIM station configuration data to be entered, stored, retrieved, and printed: a. WIM Station Number; b. WIM Model Number; c. Location Information; I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Intersection/Interchange. d. Road Classification (interstate, freeway/expressway, principal arterial, minor arterial, collector, local); e. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); f. Link ID; g. Polling Enabled (yes/no, defaults to yes); h. Associated CCTV; i. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84); V. Height (-127 to 127); VI. Vertical Level (-127 to 127).	2	Demo

3.8.2 Tunnel Operations Center Interface Requirements

CapTOP's interface requirements to the Supervisory Control and Data Acquisition (SCADA) system supporting tunnel operations are described below. Also refer to requirements

- SYS-80;
- INM-100.9;
- GUI-260..

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SCA-10	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, 9th Street and 12th Street Tunnels.	2	Demo
SCA-20	OR-TOPS-2	CapTOP shall provide an interface to receive overheight vehicle notifications from the 3rd Street Tunnel SCADA system.	2	Demo
SCA-30	OR-TOPS-3	CapTOP shall provide alarms to the user alerting of overheight vehicle detections obtained from the 3rd Street Tunnel SCADA system.	2	Demo

3.8.3 Streetcar System Interface Requirements

CapTOP's Streetcar interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-80;
- GUI-260;
- INM-100.

In addition, CapTOP shall meet the requirements below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
STC-10	N/A	CapTOP shall provide an interface with the Streetcar Operations Center to exchange traffic signal operation information	2	Demo
STC-20	N/A	CapTOP shall provide an interface with the Streetcar Operations Center to access streetcar location information in real time.	2	Demo
STC-30	N/A	CapTOP shall interface with the Streetcar Operations Center through a Web-based interface.	2	Demo
STC-40	N/A	CapTOP shall provide an interface with the Streetcar Operations Center to provide video streams and control of a limited number of cameras in the vicinity of streetcar lines subject to user privilege priority.	2	Demo
STC-50	N/A	CapTOP shall provide an interface with the Streetcar Operations Center to accept video streams by cameras on streetcars and stations.	2	Demo

3.8.4 CityWorks Interface Requirements

CapTOP's CityWorks interface requirements are addressed in the Asset Management Section. Refer to section **Error! Reference source not found. Error! Reference source not found.**.

3.8.5 Asset Management Requirements

CapTOP's Asset Management functions are fulfilled by the DC's CityWorks application. CapTOP's CityWorks interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-150.3;
- GUI-50.1.1;
- GUI-280.

In addition, CapTOP shall meet the requirements below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
ASM-10	OR-DDM-1	CapTOP shall interface with a Commercial-Off-The-Shelf (COTS) asset management system for managing the following maintenance activities: d. work order generation; e. work order scheduling; f. work order tracking; g. inventory management.	1	Demo
ASM-20	OR-DDM-2, OR-DOC-33	CapTOP shall be able to initiate work order requests through CityWorks for problems involving ITS devices.	1	Demo
ASM-20.1	OR-DDM-8, OR-DDM-9, OR-DDM-10	CapTOP shall provide the Maintenance Staff and TMC Operator the ability to enter, update, and delete the following types of work orders: a. new device/equipment installation; b. preventive maintenance; c. corrective maintenance; d. problem reports from citizens.	1	Demo
ASM-20.2	OR-DDM-5	CapTOP shall provide Maintenance Staff a web-based interface to create, update, and delete work orders remotely.	1	Demo
ASM-20.2.1	OR-DDM-17	CapTOP shall allow the Maintenance Technician to receive, create, update, and delete work orders in the field through the use of PDAs and wireless enabled laptops.	2	Demo
ASM-20.3	OR-DDM-4	CapTOP shall provide the TMC Maintenance Staff the capability to create, update, and delete work orders and reports from the DDOT LAN and from remote locations.	1	Demo
ASM-20.4	OR-DDM-22	CapTOP shall prevent entry of duplicate work orders for the same problem at the same location.	1	Demo
ASM-30	OR-DDM-6	CapTOP shall provide an electronic inventory system that manages and provides information on in-use and spare parts.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
ASM-30.1	OR-DDM-6	CapTOP shall maintain equipment inventories for all ITS devices down to the component level of each device.	1	Demo
ASM-30.2	OR-DDM-6	CapTOP shall provide an electronic inventory system that manages and provides information on spare parts availability for the DDOT stock room.	1	Demo
ASM-30.3	OR-DDM-7	CapTOP shall provide an electronic inventory system that manages and provides information on spare parts availability for the Contractor stock room.	2	Demo
ASM-40	OR-DDM-4, OR-TOM-2	CapTOP shall have the capability, using an interface to CityWorks, to generate work order reports from the TMC or from remote locations that contain the work order #, work order type, work order description, date submitted, date completed, originator, technician assigned, and work orders status.	1	Demo
ASM-40.1	OR-DDM-11, OR-TOM-2	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	Demo
ASM-40.2	OR-DDM-11	CapTOP shall allow the user to sort the work order reports by the following fields: a. assigned technician; b. originator; c. date/time submitted; d. status; e. work order #; f. work order type.	1	Demo
ASM-40.3	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	Demo
ASM-40.4	OR-DDM-12, OR-TOM-2	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	Demo
ASM-40.5	OR-PM-7	CapTOP shall be able to monitor and track communications outages, restoration of services, field	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		device operation and malfunction, and device reliability.		
ASM-50	OR-DDM-13	CapTOP shall be able to produce a problem report (trouble ticket) and transmit to Maintenance Staff via an integrated asset management system.	1	Demo
ASM-60	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	Demo
ASM-60.1	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	Demo
ASM-70	OR-DDM-14	CapTOP shall allow the TMC Operator to view the status of any problem report.	1	Demo
ASM-80	OR-DDM-16	CapTOP shall be able to alert Maintenance Staff and the TMC Operator when there is a field device malfunction and the field device status transition as follows: a. from on-line to off-line; b. from on-line to device failure; c. from on-line to communication failure.	1	Demo
ASM-90	OR-DDM-18	CapTOP shall provide a seamless interface with the CityWorks application to utilize its asset management capabilities and features.	1	Demo
ASM-100	OR-DDM-25	CapTOP shall track status of maintenance trucks, individuals and teams/shifts during emergencies and special events.	2	Demo
ASM-110	OR-DDM-26	CapTOP shall log status changes of maintenance trucks and maintenance teams during emergencies.	2	Demo
ASM-120	OR-DDM-28	CapTOP shall be able to track maintenance activity, by asset, and by activity, for performance and budget purposes.	1	Demo
ASM-130	OR-DDM-29	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; g. repair history.	1	Demo
ASM-140	OR-DDM-30	CapTOP shall be able to track and accommodate diagnostics for the following types of communication links: a. DSL circuits; b. twisted pair circuits; c. wireless communication links; d. fiber optic links.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
ASM-150	OR-DDM-4	CapTOP shall have the ability to provide a consolidated real-time status report that list the status of each subsystem device to the CityWorks system. Refer to each subsystem for additional details.	2	Demo
ASM-160	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	Demo
ASM-170	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	Demo
ASM-180	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. traffic detection stations; 7. WIM sensors; 8. permanent count stations. c. communication networks; d. traffic signals.	1	Demo

3.8.5.1 Inventory Management

Refer to requirements ASM-10 and ASM-30*.

3.8.5.2 Repair and Maintenance

Refer to requirements ASM-50, ASM-60*, and ASM-150 through 180.

3.8.6 Interface to Signal Maintenance Contractor's Work Order Database

CapTOP's interface requirements to the Signal Contractor's Maintenance Work Order Database (currently McDean) are described below. Also refer to requirement SYS-150.3.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
SMC-10	OR-DDM-27	CapTOP shall provide an interface with Signal Maintenance Contractor's Traffic Information Management System (TIMS) to display data downloaded from the TIMS system.	1	Demo
SMC-20	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	Demo

3.8.7 StormTrak Interface Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
STI-10	OR-WEM-6	CapTOP shall provide an interface with the StormTrak system to retrieve the following data: a. regional weather information; b. roadway weather condition information; c. snow operation routes; d. snow operation route status (treated, not-treated, cleared only, not-cleared, treated and cleared; rated 1-6); e. snow operation route condition (treated and drivable, needs treatment and drivable, needs treatment but not drivable); f. time last treated; g. time last cleared.	2	Demo
STI-10.1	OR-WEM-6	CapTOP shall provide an interface to the StormTrak server in accordance with the latest published draft of the StormTrak API (TBD).	2	Demo
STI-20	IR-GUI-60, OR-WEM-7	CapTOP shall provide a map-based display and GUI to show the weather-related information obtained from the StormTrak system.	2	Demo
STI-20.1	IR-GUI-62	CapTOP shall provide an interface with the map-based display to show snow removal routes which have been assigned to a snow removal vehicles.	2	Demo
STI-30	SR-SYS-24	CapTOP shall provide access to StormTrak data to allow the TMC Operator to perform the following activities: a. deploy road maintenance resources; b. issue general traveler advisories; c. provide location specific weather and traffic warnings to drivers using the DMS/PDMS/HAR/Internet.	2	Demo
STI-30.3	SR-SYS-24	CapTOP shall be able to display StormTrak-status information via the Internet (refer to STI-10).	2	Demo
STI-30.4	OR-WEM-10, OR-WEM-11	CapTOP shall be able to display messages related to adverse weather activities on the Internet during inclement weather events.	2	Demo
STI-40	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.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
STI-50	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.	2	Demo

3.8.8 RWIS Interface Requirements

3.8.8.1 Accessing the Roadway Weather Information System (RWIS) Interface

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-10	OR-DOC-1, OR-CMM-4	CapTOP shall allow the TMC Operator to access the RWIS interface, subject to operator privilege level.	C	Demo
RWI-10.1	OR-DOC-1, OR-WEM-1, OR-WEM-2	CapTOP shall allow the TMC Operator to access the RWIS status interface, using the following mechanisms: a. Left clicking on a RWIS station icon on the map display; b. Left clicking on the RWIS status interface icon off the CapTOP toolbar; c. Left clicking on the RWIS status interface menu off the CapTOP toolbar.	1	Demo
RWI-10.2	OR-SMM-5, OR-DOC-1	CapTOP shall provide role-based privileges to control access to the following, subject to the user's privilege level: a. RWIS events and alarms; b. RWIS status (refer to RWI-40).	C	Demo
RWI-20	IR-GUI-10	CapTOP shall display all RWIS station icons on a separate layer on the map-based display.	1	Demo
RWI-20.1	IR-GUI-12	CapTOP shall allow the TMC Operator to turn on and off the RWIS layer on the map display.	1	Demo
RWI-20.2	IR-GUI-10, IR-GUI-11	CapTOP shall allow a RWIS station icon to be left clicked on the map display by the TMC Operator and permit access to the RWIS status window (refer to RWI-40 and RWI-60), with no more than 2 additional clicks.	1	Demo
RWI-20.3	IR-GUI-12	The icons used for the RWIS stations icon layer shall be unique from icons used in other layers.	1	Demo
RWI-30	IR-GUI-10	CapTOP shall provide the ability for the System Administrator to add, delete, and modify RWIS stations from the CapTOP map display (also refer to GUI-200*).	C	Demo
RWI-30.1	IR-GUI-10	CapTOP shall allow the System Administrator to point and click on a location on the map display to add a new RWIS station icon using a pop-up menu.	1	Demo
RWI-30.2	IR-GUI-10	When a RWIS station icon is added, CapTOP shall prompt the System Administrator with a window to enter all configuration data required to integrate the device.	C	Demo
RWI-30.2.1	IR-GUI-10, OR-TDCA-20, OR-TDCA-21	CapTOP shall allow the following configuration data to be entered for each RWIS station to enable the device to become operational in the system:	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		a. RWIS ID; b. Description; c. Controller Type; d. Location Information: I. Location Description; II. Street Address; III. Road Name; IV. Road Direction; V. Exit Number; VI. Milepost; VII. Intersection/Interchange (at least 2 streets, for roundabout will be more than 2 streets). e. Online-Offline Mode (static – set by System Administrator or Maintenance Technician); f. Communication Type (dialup serial, network serial, IP); g. Multidrop Information; I. Drop Address; II. Channel ID; III. Port Name. h. IP Information; I. IP Address; II. Port Number. i. Serial Information; I. Baud Rate; II. No. Data Bits; III. Parity; IV. No. Stop Bits; V. H/W Flow Control; VI. S/W Flow Control. j. NTCIP Community; k. Firmware Version; l. Cabinet Number; m. Controller Model Number; n. Protocol; o. Link ID; p. Polling Enabled (yes/no, defaults to yes); q. Comm Loss Timeout (seconds in .1 increments); r. Associated CCTV; s. TMDD Information; I. Horizontal Datum (WGS84, 84EGM96, NAD83); II. Latitude (decimal degrees); III. Longitude (decimal degrees); IV. Vertical Datum (WGS84);		

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		V. Height (-127 to 127); VI. Vertical Level (-127 to 127).		
RWI-30.2.2	IR-GUI-10	When a RWIS device icon is added, CapTOP shall prompt the System Administrator or Maintenance Technician with setting the device online or offline.	1	Demo
RWI-30.2.3	IR-GUI-10	If the user enters a latitude/longitude pair for the device, the device icon location on the map shall be updated automatically based on the coordinates specified (and not where there user clicked to create the icon).	1	Demo
RWI-30.3	IR-GUI-10, IR-GUI-11	CapTOP shall allow a RWIS station icon to be right clicked on the map display and permit access to the following functions by the System Administrator or Maintenance Technician, with no more than 2 additional clicks: a. setting the online-offline mode; b. entering, deleting, or modifying configuration information; c. allowing the device icon to be relocated on the map display; d. allowing the device icon to be deleted.	1	Demo
RWI-30.4	OR-IM-4	CapTOP shall strictly enforce the use of pull-down menus, radio buttons, or selection boxes when any of the following fields are entered by the user: a. Street Address/Block; b. Road Name; c. Road Direction; d. Exit Number; e. Milepost; f. Intersection/Interchange; g. Online-Offline Mode (online/offline); h. Communication Type (dialup serial, network serial, IP); i. Protocol; j. Link ID; k. Polling Enabled (yes/no, defaults to yes); l. Associated CCTV.	1	Demo
RWI-30.4.1	OR-IM-4	CapTOP shall restrict the use of free-form text entry on the fields identified above.	1	Demo
RWI-30.4.2	OR-IM-4	CapTOP shall allow the user to type the 1st 3 characters in each field and the system will provide a filtered list of selections for that field that begin with the 1st 3 characters typed by the user.	2	Demo
RWI-30.4.3	OR-IM-4	CapTOP shall allow the user to select “Other” and enter in free form text when a desired entry cannot be found in the list.	1	Demo

3.8.8.2 Monitoring RWIS Status

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-40	OR-DOC-10, IR-GUI-14, IR-GUI-16, OR-WEM-3, OR-WEM-4, UR-TO-25, OR-WEM-1	CapTOP shall allow the TMC Operator to retrieve and display the following "summary" operational status and operational data for any RWIS, subject to operator privilege level: a. RWIS ID; b. Online-offline mode (static – set by System Administrator or Maintenance Technician); c. Communication station status (OK, failed); d. Air readings: I. air temperature; II. relative humidity; III. barometric pressure; IV. dew point. e. Wind readings: I. average wind speed; II. wind gusts; III. average wind direction. f. Visibility readings: I. visibility level. g. Precipitation readings: I. precipitation (yes/no); II. precipitation type; III. precipitation rate; IV. precipitation intensity. h. Surface condition readers: I. road surface temperature; II. subsurface temperature; III. surface condition (dry, wet, frozen); IV. freeze point temperature; V. chemical factor; VI. chemical percent; VII. solution depth. i. Video snapshot of the RWIS area; j. Alarm status.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-40.1	OR-DOC-10, IR-GUI-14, IR-GUI-16, OR-WEM-3, OR-WEM-4, UR-TO-25, OR-WEM-1	CapTOP shall allow the TMC Operator to retrieve and display the following "extended" operational status and operational data for any RWIS, subject to operator privilege level: a. RWIS ID; b. Online-offline mode (static – set by System Administrator or Maintenance Technician); c. Communication station status (OK, failed); d. Pavement Data (refer to **Error! Reference source not found.**); e. Surface Status Data (refer to **Error! Reference source not found.**); f. Atmospheric Data (refer to **Error! Reference source not found.**); g. Camera Data (refer to **Error! Reference source not found.**); h. Device Data (refer to **Error! Reference source not found.**); i. Traffic Data (refer to **Error! Reference source not found.**).	1	Demo
RWI-40.2	OR-DOC-1, OR-WEM-1	CapTOP shall be able to monitor all RWISs by interfacing with the SCAN Web server to obtain their operational status and operational data.	C	Demo
RWI-40.2.1	OR-DOC-3, IR-GUI-14	CapTOP shall interface with the RWIS SCAN Web server database in accordance with the SCAN Web API (using the most recent DDOT-installed revision of the "SCAN Server Data Export software" and documentation) to access the RWIS operational status and operational data.	1	Demo
RWI-40.2.2	OR-DOC-2, OR-DOC-3, IR-GUI-29	CapTOP shall support a polling interval range from 0 to 99999 seconds, where zero indicates no polling.	1	Demo
RWI-40.3	OR-DOC-1	CapTOP shall use data from the following sources to determine operational status: a. data reported from the RWIS SCAN Web server; b. data gained by CapTOP in attempts to communicate with the RWIS SCAN Web server; c. online/offline information entered manually by authorized CapTOP users.	C	Demo
RWI-50	IR-GUI-14	CapTOP shall provide the monitoring interface using communication servers for monitoring the RWISs.	C	Demo
RWI-60	SR-SYS-2, IR-GUI-36, IR-GUI-26	CapTOP shall allow users to simultaneously view RWIS status, which is refreshed automatically by the system based on the polling interval, using the following methods: a. Color coded icons on the map display; b. Via the RWIS status window which lists all RWISs, the RWIS ID, location information, online-offline mode, communication station status, and controller status.	C	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method

RWI-60.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following colors for device icon states:
		a. Green = online;
		b. Red = device failure;
		c. Yellow = communication failure;
		d. Gray = offline.
			C	Demo

RWI-60.1.1	IR-GUI-28, IR-GUI-26	CapTOP shall use the following rules for device icon states: a. If the device is online but in communication failure, the device icon color should be that of a device with a communication failure; b. In order for the device icon to be green, the device must be both online and have OK communication.	1	Demo
RWI-60.2	IR-GUI-31, IR-GUI-29	The refresh rate for the status of the icons and for the data in the status window shall be configurable and based upon the polling rate.	1	Demo
RWI-60.3	IR-GUI-31	CapTOP shall allow the user to obtain summary status information (refer to RWI-40 for the list of fields) by hovering over an RWIS icon.	1	Demo
RWI-60.4	IR-GUI-29	CapTOP shall allow the user to select on any RWIS in the RWIS status window (refer to RWI-60 item b) and view all details (full status, configuration information) pertaining to that RWIS.	1	Demo
RWI-70	SR-SYS-2, IR-GUI-31, IR-GUI-32	CapTOP shall provide a menu option to search for a RWIS by the following methods: a. by RWIS ID; b. by IP address/drop address/channel ID of the controller; c. by street name; d. by geographical address; e. by intersection/interchange.	1	Demo
RWI-70.1	SR-SYS-2, IR-GUI-31	CapTOP shall allow the TMC Operator to search for RWISs using a rubber-band style box on the map display to search an area.	1	Demo
RWI-70.2	SR-SYS-2, IR-GUI-31	The result of each search shall be a list of RWISs that are sorted, by default, by RWIS ID.	1	Demo
RWI-70.3	SR-SYS-2, IR-GUI-31	The result of each search shall be a list of RWISs sortable by RWIS ID, IP address/drop address/channel ID, street name, geographical address, and intersection/interchange.	1	Demo
RWI-80	OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall be able to store RWIS operational status and operational data (refer to RWI-40) in the CapTOP operations database.	C	Demo
RWI-90	OR-WEM-5	CapTOP shall provide an RWIS alert under the following conditions: a. Whenever there is precipitation of any type from any RWIS station, and when the surface temperate and ambient temperatures are 32 degrees Fahrenheit and below. b. Whenever precipitation is detected from any RWIS station that is snow, sleet, or ice.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-90.1	OR-WEM-5	CapTOP shall provide a configurable user distribution list for each alert, along with the ability to send those alerts to each distribution list.	1	Demo
RWI-90.2	OR-WEM-5	CapTOP shall ensure that alerts are not transmitted repeatedly for the same weather event.	1	Demo

TABLE 9 Extended Status Data Definitions for RWIS Stations

Pavement Data		
Data Type	**Abbr.**	**Definition**
Surface Status	Status	Condition of the pavement surface
Surface Temperature	Sfc	Temperature of the pavement sensor roughly 3 mm (1/8 inch) below the surface of the sensor.
Subsurface Temperature	Sub	Typically, the temperature approximately 43 cm (17 inches) below the top of the pavement. You can place additional subsurface sensors at different depths to monitor frost depth.
Subsurface Moisture	Moisture	The sub-surface moisture expressed as a percentage (eg. 0 indicates dry, 100 indicates saturated). This value is only displayed for NTCIP sites configured with the appropriate sensor.
Delta Time	Delta T	Raw measurement from the Time Domain Reflectometry MP-917 Soil Moisture probe. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Freeze Point	Frz	Freezing point of the moisture on the pavement sensor based upon the specific chemical in use. This field is reported when the surface status is Wet, Chemical Wet, or Snow/Ice Warning. Only reported by the FP2000 and active sensors.
Chemical Percent	Chem	Percent of chemical saturation in the moisture. This field is reported when the surface status is Wet, Chemical Wet, or Snow/Ice Warning. Only reported by the FP2000 sensor.
Ice Percentage	Ice	Percent of ice in the moisture. When ice percentage is roughly 50% to 85%, you would typically call the surface moisture "slush". This field is reported when the surface status is Wet, Chemical Wet, or Snow/Ice Warning. Only reported by the FP2000 sensor.
Depth	Dpth	Depth of water layer on the sensor. This field is reported when the surface status is Wet, Chemical Wet, or Snow/Ice Warning and the surface temperature is above the freeze point temperature. Only reported by the FP2000 sensor.
Chemical Factor	CF	Relative indication of chemical present in the moisture on the surface. Chemical factor uses a relative scale ranging from 0 to 100.
Conductivity	Cond	The conductance of the ice/liquid mixture on the pavement. This value is only displayed for NTCIP sites configured with the appropriate sensor.

Pavement Data		
Data Type	**Abbr.**	**Definition**
Salinity	Salin	Salinity is roughly the number of grams of dissolved matter per kilogram of seawater. Units shown in parts per 100,000. This value is only displayed for NTCIP sites configured with the appropriate sensor.

The following surface status codes are listed in order of severity with the most critical status listed first

Surface Status Data	
Status	**Description**
Snow/Ice Warning	Continuous film of ice and water mixture at or below freezing (32°F / 0°C) with insufficient chemical to keep the mixture from freezing. This status can only be reported at SSI ESP and SP sites when precipitation occurs.
Ice Warning	Continuous film of ice and water mixture at or below freezing (32°F / 0°C) with insufficient chemical to keep the mixture from freezing. This status can only be reported at NTCIP sites.
Snow Warning	This status can be reported at NTCIP sites, but will not be reported by SSI NTCIP sites.
Wet Below Freezing	Moisture on pavement sensor with a surface temperature below freezing (32°F / 0°C). This status will only be reported at SSI SCAN Detector sites.
Frost	Moisture on pavement at or below freezing (32°F / 0°C) with a pavement temperature at or below the dew point temperature. This status can only be reported by SSI ESP, SP, and NTCIP sites when precipitation is not occurring.
Ice Watch	Thin or spotty film of moisture at or below freezing (32°F / 0°C). This status can only be reported at NTCIP sites when precipitation is not occurring.
Snow Watch	This status can be reported at NTCIP sites, but is not detected at SSI NTCIP sites.
Snow/IceWatch	Thin or spotty film of moisture at or below freezing (32°F / 0°C). This status can only be reported at SSI ESP and SP sites when precipitation is not occurring.
Chemical Wet	Continuous film of water and ice mixture at or below freezing (32°F or 0°C) with enough chemical to keep the mixture from freezing. This status can only be reported by SSI ESP, SP, and NTCIP sites when precipitation occurs.
Wet	Continuous film of moisture on the pavement sensor with a surface temperature above freezing (32°F or 0°C). This status can be reported by SSI ESP, SP, SCAN Detector, and NTCIP sites when precipitation has occurred.
Damp	Thin or spotty film of moisture above freezing (32°F or 0°C). This status can only be reported by SSI ESP, and SP sites when precipitation is not occurring.
Trace Moisture	Thin or spotty film of moisture above freezing (32°F or 0°C). Surface moisture occurred without precipitation being detected. This status will only be reported at NTCIP sites when precipitation is not occurring.
Absorption at Dew Point, Absorption, & Dew	These statuses can be reported at NTCIP sites, but are not currently detected at SSI NTCIP sites.

Surface Status Data	
Status	**Description**
Dry	Absence of moisture on the surface sensor. This status can be reported by SSI ESP, SP, SCAN Detector, and NTCIP sites.
Other	Other is the standard NTCIP ESS surface condition code to handle conditions not explicitly included in this table. This status will only be reported NTCIP by sensors installed at NTCIP ESS sites.
No Report	The surface sensor is not operating properly and requires maintenance. This status will only be reported by SSI ESP and SP sites.
Error	The surface sensor is not operating properly and requires maintenance. This status will only be reported by NTCIP sites.

Atmospheric Data Definitions		
Data Type	**Abbr.**	**Definition**
Air Temperature	Air	Air temperature at the site.
Max Temp	Max	The maximum temperature recorded during the 24 hours preceding the observation. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Min Temp	Min	The minimum temperature recorded during the 24 hours preceding the observation. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Dew Point Temperature	Dew	Temperature at which the air becomes saturated as it cools. If the road or runway temperature drops to or below the dew point, moisture may develop on the surface. The form the moisture takes depends on the surface temperature and the amount of chemical present.
Relative Humidity	RH	Percent of moisture in the air. A relative humidity of 0% shows that the air contains no moisture and 100% shows that the air is completely saturated and cannot absorb more moisture.
Wind Chill Factor	WndChll	Forecasted Wind Chill Factor.
Heat Index	Heat	Forecasted Heat Index.
Wind Speed	SpdAvg	Average speed of the wind during an evaluation cycle.
Wind Direction	DirAvg	Average wind direction during an evaluation cycle. Wind direction can be displayed in two formats: cardinal points or degrees. Cardinal format has 8 possible headings. Degree format displays wind direction in values ranging from 1 to 360. **Direction** / **Cardinal Format** / **Degree Range** North / N / 338 - 22 Northeast / NE / 23 - 68

Atmospheric Data Definitions		
Data Type	**Abbr.**	**Definition**
		<table><tr><td>East</td><td>E</td><td>69 - 112</td></tr><tr><td>Southeast</td><td>SE</td><td>113 - 158</td></tr><tr><td>South</td><td>S</td><td>159 - 202</td></tr><tr><td>Southwest</td><td>SW</td><td>203 - 248</td></tr><tr><td>West</td><td>W</td><td>249 - 292</td></tr><tr><td>Northwest</td><td>NW</td><td>293 - 337</td></tr></table>
Gust	SpdGst	Maximum wind speed measured during an evaluation cycle. The time period over which wind gust speed is monitored can vary based on the type and manufacturer of the RWIS site.
Probability of Precipitation	Prob	Likelihood of precipitation during a forecasted period.
Cloud Cover	Cloud Cover	Forecasted cloud cover percentage during a period.
Precipitation Type	Precip	Type of precipitation detected by a precipitation sensor, if one is available. Certain types of precipitation sensors can only detect the presence or absence of precipitation and will display Yes or No. Other types of precipitation sensors, such as the Weather Identifier and Visibility Sensor (WIVIS) or Optical Weather Identifier (OWI), can classify the type of precipitation and will report a specific type of precipitation. The WIVIS and OWI precipitation sensors may report Yes at the onset of precipitation until sufficient time has elapsed to classify the precipitation type.
Precipitation Rate	Rate	Average precipitation rate computed every minute. Snowfall is converted to water equivalent and the rate represents the rate of liquid equivalent.
Precipitation Intensity	Intens	Intensity of the precipitation as derived from the precipitation rate. The National Weather Service defines the following intensity classes: light, moderate, or heavy.
Time Since Last Precip	TimeSince	The time interval since the last precipitation event occurred. This value is not supported for NTCIP sites.
Precipitation Start Time	StartTime	The time at which the most recent precipitation event began. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Precipitation End Time	EndTime	The time at which the most recent precipitation event ended. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Precipitation Accumulation	Accum	Rainfall amount or snowfall liquid equivalent for the period from midnight GMT to the current time. At midnight GMT the total accumulation is reset to zero. See the accumulation definitions below for the proper NTCIP accumulation definitions.
Snow Depth	Snow Depth	The depth of snow on representative areas other than the highway pavement, avoiding drifts and plowed areas. Snow depth is only supported at NTCIP sites.

Atmospheric Data Definitions		
Data Type	**Abbr.**	**Definition**
Snow Accumulation	Snow Accum	Forecasted snowfall accumulation during a forecast period.
10 Minute Precip Accum	10 min	Rainfall amount or snowfall liquid equivalent for the previous 10 minute period. This value is only displayed for NTCIP sites configured with the appropriate sensor.
1 Hour Precip Accum	1hr	Rainfall amount or snowfall liquid equivalent for the previous 1 hour period. This value is only displayed for NTCIP sites configured with the appropriate sensor.
3 Hour Precip Accum	3hr	Rainfall amount or snowfall liquid equivalent for the previous 3 hour period. This value is only displayed for NTCIP sites configured with the appropriate sensor.
6 Hour Precip Accum	6hr	Rainfall amount or snowfall liquid equivalent for the previous 6 hour period. This value is only displayed for NTCIP sites configured with the appropriate sensor.
12 Hour Precip Accum	12hr	Rainfall amount or snowfall liquid equivalent for the previous 12 hour period. This value is only displayed for NTCIP sites configured with the appropriate sensor.
24 Hour Precip Accum	24hr	Rainfall amount or snowfall liquid equivalent for the previous 24 hour period. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Barometric Pressure	BaroPs	The force per unit area exerted by the atmosphere. This reading is **not** adjusted for site elevation.
10 Minute Solar Radiation	10 Min Rad	The direct solar radiation integrated over the preceding 10 minutes. This value is only displayed for NTCIP sites configured with the appropriate sensor.
24 Hour Solar Radiation	24 Hr Rad	The direct solar radiation integrated over the preceding 24 hours. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Total Sun	Sun	The total amount of sunshine in minutes over the preceding 24 hours. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Visibility	Vis	Average distance that you can see, both day and night, computed every three minutes.
Wet Bulb Temp.	WtBlb	The wet bulb temperature is the temperature of a thermometer whose bulb is wrapped in wet muslin. The wetbulb is always in between the temperature and dew point, except at saturation, when all three are equivalent. This value is only displayed for NTCIP sites configured with the appropriate sensor.
Water Level	Height	Water level height is the relative water level height from the water level sensor's calibrated "normal" height.
Ozone	Ozone	Concentration of ozone in the air as a fraction of volume. Shown in parts per billion.

The following Bridge Sprayer definitions only apply to NTCIP sites.

Bridge Spray Data		
Data Type	**Abbr.**	**Definition**
Sprayer Status	Status	Status of the bridge sprayer control system.
Last Activation	Last Activation	Date and Time the RWIS requested the bridge sprayer to be activated.
Start Time	Start Time	Date and time the bridge sprayer began the chemical application cycle. Start Time will only be reported for bridge sprayers configured to provide sprayer feedback to the RWIS site.
End Time	End Time	Date and time the bridge sprayer completed the chemical application cycle. End Time will only be reported for bridge sprayers configured to provide sprayer feedback to the RWIS site.
Tank Level	Tank Level	The amount of deicing chemical remaining in the bridge sprayer holding tank. Tank Level is only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Tank Level Start	Start	The amount of deicing chemical present in the bridge sprayer holding tank at the start of a spray event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Tank Level End	End	The amount of deicing chemical present in the bridge sprayer holding tank at the completion of a spray event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Tank Level Amount	Amount	The amount of deicing chemical used during a spray event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Line Pressure	Line Pressure	The line pressure reported by the bridge sprayer in pounds per square inch. Line Pressure is only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Average Line Pressure	Average	The average line pressure reported by the bridge sprayer during a spray event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Low Line Pressure	Low	The lowest line pressure reported by the bridge sprayer during a spray event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
High Line Pressure	High	The highest line pressure reported by the bridge sprayer during a spray event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Flow Since Last Event	Flow Since	The amount of chemical that has leaked (as reported by the flow sensor) since the completion of the last spray event. This counter will reset after each firing and when the sprayer or RPU is restarted. This value is only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Average Flow Rate	Average	The average chemical applied per minute by the bridge sprayer during a sprayer event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Low Flow Rate	Low	The lowest flow rate reported by the bridge sprayer during a sprayer event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
High Flow Rate	High	The highest flow rate reported by the bridge sprayer during a sprayer event. Only reported by a bridge sprayer connected via a Bridge Sprayer Controller.
Requested by	Requested by	The SCAN Web user that manually requested a bridge sprayer configuration change.
User Activation	User Activation	The SCAN Web user that manually requested a bridge sprayer activation.
Request	Request	The date and time that a bridge sprayer configuration change was requested by a SCAN

Bridge Spray Data		
Data Type	**Abbr.**	**Definition**
Date/Time	Date/Time	Web user.
Effective Date/Time	Effective Date/Time	The date and time that a user requested bridge sprayer configuration change was delivered to the RWIS site. An * will be displayed if the configuration was not delivered to the site.
Sprayer Mode	Mode	Bridge sprayers can be configured in one of three modes: Automatic, On Demand, and Disabled. Automatic mode also allows On Demand requests from the SCAN Web Bridge Sprayer Activation page.
Max Operating Temperature	Max Temperature	The upper bound of the operational surface temperature range that controls whether the bridge sprayer can be automatically activated.
Min Operating Temperature	Min Temperature	The lower bound of the operational surface temperature range that controls whether the bridge sprayer can be automatically activated.
Wind Speed Hold Off	Wind Speed Hold Off	The maximum wind speed under which the bridge sprayer is configured to automatically activate.
Freeze Temperature Offset	Freeze Temp Offset	Activate sprayer when the surface temperature is within this many degrees or is less than the freeze point. A negative value can be specified to delay the automatic activation of the sprayer.
Freeze Condition Hold Off	Freeze Hold Off	Number of minutes required to elapse before reactivating the sprayer due to a freeze condition.
Dew Point Offset	Dew Point Offset	Activate sprayer when the surface temperature is within this many degrees or is less than the dew point. A negative value can be specified to delay the automatic activation of the sprayer.
Frost Condition Hold Off	Frost Hold Off	Number of minutes required to elapse before reactivating the sprayer due to a frost condition.

The following bridge sprayer status codes are only supported for bridge sprayers installed at NTCIP sites.

Bridge Sprayer Status Data	
Sprayer Status	**Description**
Spraying	Feedback status from the bridge sprayer indicates the sprayer is currently applying chemical. This status will be reported after each activation status listed below or if the sprayer has been activated from an external source. The sprayer must provide activation feedback to report this status.
Waiting for confirmation to spray	Before a request for sprayer activation occurs, the RPU must detect conditions that meet one of the automatic sprayer activation definitions for two consecutive sensor evaluation cycles. This status will be reported when the RPU initially detects the conditions. Once the conditions are confirmed, the RPU will request the sprayer is activated and the proper activation status will be displayed.

Bridge Sprayer Status Data	
Sprayer Status	**Description**
Spraying Completed	The bridge sprayer has completed a spraying cycle. This status will be reported upon completion of each sprayer activation. The sprayer must provide activation feedback to report this status.
Active due to manual user request	A user manually requested a sprayer activation. Manual requests can be initiated from the SCAN Web Bridge Sprayer Activation page or directly from maintenance mode at the site.
Active due to freeze point condition	The RPU initiated a sprayer activation because the surface temperature is within the user specified temperature range or is less than the freeze point temperature. A negative value can be specified to delay the automatic activation of the sprayer. This status will only occur when the user specified average wind speed threshold has not been exceeded, the current surface temperature falls within the user defined operating surface temperature range, and the user defined freeze point condition hold off time has expired.
Active due to frost condition	The RPU initiated a sprayer activation because the surface temperature is within the user specified temperature range or is less than the dew point. A negative value can be specified to delay the automatic activation of the sprayer. This status will only occur when the user specified average wind speed threshold has not been exceeded, the current surface temperature falls within the user defined operating surface temperature range, and the user defined frost condition hold off time has expired.
Active due to rain and wet surface conditions	The RPU initiated a sprayer activation because the surface temperature is within the user specified temperature range or is less than freezing and rain is occurring. Moisture must also be present on the pavement. A negative value can be specified to delay the automatic activation of the sprayer. This status will only occur when the user specified average wind speed threshold has not been exceeded, the current surface temperature falls within the user defined operating surface temperature range, the user defined precipitation condition hold off time has expired, and the automatic precipitation activation option has been enabled.
Active due to freezing rain condition	The RPU initiated a sprayer activation because the surface temperature is within the user specified temperature range or is less than freezing and freezing rain is occurring. Moisture must also be present on the pavement. A negative value can be specified to delay the automatic activation of the sprayer. This status will only occur when the user specified average wind speed threshold has not been exceeded, the current surface temperature falls within the user defined operating surface temperature range, the user defined precipitation condition hold off time has expired, and the automatic precipitation activation option has been enabled.
Active due to snow condition	The RPU initiated a sprayer activation because the surface temperature is within the user specified temperature range or is less than freezing and snow is occurring at a rate greater than .2"/hr (5mm/hr). A negative value can be specified to delay the automatic activation of the sprayer. This status will only occur when the user specified average wind speed threshold has not been exceeded, the current surface temperature falls within the user defined operating surface temperature range, the user defined precipitation condition hold off time has expired, and the automatic precipitation activation option has been enabled.
Inactive due to high surface temperature	The RPU will not initiate a sprayer activation because the current surface temperature is warmer than the user defined surface temperature operating range.

Bridge Sprayer Status Data	
Sprayer Status	**Description**
Inactive due to low surface temperature	The RPU will not initiate a sprayer activation because the current surface temperature is colder than the user defined surface temperature operating range.
Inactive due to high winds	The RPU will not initiate a sprayer activation because the average wind speed is exceeding the user defined maximum wind speed.
Inactive due to freeze point hold off time	The RPU will not initiate a sprayer activation because the user specified freeze condition hold off time has not yet expired.
Inactive due to frost hold off time	The RPU will not initiate a sprayer activation because the user specified frost condition hold off time has not yet expired.
Inactive - critical conditions not detected	The RPU will not initiate a sprayer activation because the user specified freeze and frost conditions are not being reported.
Sprayer currently disabled per user request	The bridge sprayer has been disabled and cannot be automatically activated or manually activated on-demand until the sprayer is enabled.
The sprayer was triggered by the RWIS; however, the sprayer did not respond.	An activation request was sent to the bridge sprayer; however, the bridge sprayer was not activated.

Cameras supporting multiple camera positions are only supported for NTCIP sites.

Camera Configuration Data		
Data Type	**Abbr.**	**Definition**
Request Date/Time	Request Date/Time	The date and time that a camera configuration change was requested by a SCAN Web user.
Requested by	Requested by	The SCAN Web user that manually requested a camera configuration change.
Effective Date/Time	Effective Date/Time	The date and time that a user requested camera configuration change was delivered to the RWIS site. An * will be displayed if the configuration was not delivered to the site.
Camera Positions	Camera Positions	List containing all of the enabled camera positions at an NTCIP site.

Devices using basic relay control are not supported for NTCIP sites. Generic Devices are only supported for NTCIP site.

Device Data		
Data Type	**Abbr.**	**Definition**
Status	Status	Status displays whether a device using basic relay control is currently "On" or "Off".
Set By / Requested By	Set By	Identifies the source that last controlled the device. "RPU" will be shown when the RPU determined that the device's state should have been set.
Command	Command	Identifies any user initiated device command that was sent from a user application.
Mode	Mode	Mode identifies the control mode the site is using to control the generic device. Supported modes are "Automatic" and "Manual". "Other" will be reported during the site restart process. Mode is only supported on NTCIP sites.
Control State	Control State	Control State displays the current state the RPU is sending to the generic device. The states are configurable per site and are only supported on NTCIP sites.
Device Status	Device Status	Device Status displays whether the generic device is either "On" or "Off", experiencing an "Error" condition, or in a transitional "Pending" state. "Other" will be reported during the site restart process. These status codes are only available on NTCIP sites.
Request Date/Time	Request Date/Time	The date and time that a generic device mode or control state change was requested by a SCAN Web user.
Effective Date/Time	Effective Date/Time	The date and time that a user requested a generic device mode or control state change was delivered to the RWIS site. An * will be displayed if the request was not delivered to the site.
Last State Change	Last State Change	The date and time the Control State was last sent by the RPU to the generic device.
Last Status Change	Last Status Change	The date and time of the last change in Device Status.

Traffic Data		
Data Type	**Abbr.**	**Definition**
Mode	Mode	Describes the configuration of the traffic sensor. The EIS RTMS traffic sensor supports three modes: Side-fired, Forward-fired In, Forward-fired Out. A permanent count station only supports the In Lane mode. • Side-fired is configured to shoot across traffic lanes and can be configured to monitor up to eight different traffic lanes. • Forward-fired In is configured to monitor a single traffic lane where traffic is traveling toward the sensor. • Forward-fired Out is configured to monitor a single traffic lane where traffic is traveling away from the sensor. • In Lane is specifies the mode for permanent count stations.
Time Interval	TimInt	Identifies the length of a single collection interval for the sensor in seconds.
Forward Average Speed	FwdAvgSpd	The average vehicle speed as a vehicle traveled through all traffic zones. Forward Average Speed is only collected in a Forward-fired configuration.
Average Traffic Speed	TrfSpd	The average vehicle speed calculated as a vehicles travel though each traffic zone.
Normal Volume	NormVol	Number of vehicles that were detected passing through a traffic zone.
Occupancy	Occup	Percentage of time that a traffic zone is occupied.
Long Volume	LongVol	Number of large vehicles (such as eighteen wheel trucks) that were detected passing through a traffic zone. This value is only available in a side-fired configuration. A Side-fired configuration can only be configured to support Long Volume or Average Headway, but not both.
Average Headway	AvgHeadway	Time interval between vehicles. This value is only available in a side-fired configuration. A Side-fired configuration can only be configured to support Average Headway or Long Volume, but not both.
Battery Voltage	Battery	Reports the remaining battery voltage. This value is only available for a permanent count station.
Speed Count	Speed Bin Name	Counts the number of vehicles for each speed range. This value is only available for a permanent count station.
Classification Count	Classification Bin Name	Counts the number of vehicles for each classification range. This value is only available for a permanent count station.

3.8.8.3 RWIS Traveler Information

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-100	SR-SYS-24	CapTOP shall provide access to RWIS data to allow the TMC Operator to perform the following activities: a. deploy road maintenance resources; b. issue general traveler advisories; c. provide location specific weather and traffic warnings to drivers using the DMS/PDMS/HAR/Internet.	1	Demo
RWI-100.1	OR-WEM-10,	CapTOP shall be able to display messages related to	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-WEM-11	snow activities on DMS and PDMS during snow events.		
RWI-100.2	OR-WEM-10, OR-WEM-11	CapTOP shall be able to play messages related to snow activities on HAR during snow events.	1	Demo
RWI-100.3	SR-SYS-24	CapTOP shall be able to display RWIS operational status and operational data via the Internet (refer to RWI-40).	1	Demo
RWI-100.4	OR-WEM-10, OR-WEM-11	CapTOP shall be able to display messages related to adverse weather activities on the Internet during inclement weather events.	1	Demo

3.8.8.4 RWIS Reports

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-110	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to automatically generate real-time tabular reports that show the real-time operational status and operational data of all RWISs.	2	Demo
RWI-110.1	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the RWIS status summary report: a. RWIS ID; b. Location Information: I. Location Description; II. Intersection/Interchange (at least 2 streets, for roundabout will be more than 2 streets). c. Alarm status; d. Online-offline mode; e. Controller status (OK, failed); f. Communication station status (OK, failed).	2	Demo
RWI-110.2	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall provide the following information in the RWIS extended status report: a. RWIS ID; b. Location Information: I. Location Description; II. Intersection/Interchange (at least 2 streets, for roundabout will be more than 2 streets). c. Alarm status; d. Online-offline mode; e. Controller status (OK, failed); f. Communication station status (OK, failed); g. Air readings: I. air temperature; II. relative humidity; III. barometric pressure; IV. dew point. h. Wind readings: I. average wind speed;	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		II. wind gusts; III. average wind direction. i. Visibility readings: I. visibility level. j. Precipitation readings: I. precipitation (yes/no); II. precipitation type; III. precipitation rate; IV. precipitation intensity. k. Surface condition readers: I. road surface temperature; II. subsurface temperature; III. surface condition (dry, wet, frozen); IV. freeze point temperature; V. chemical factor; VI. chemical percent; VII. solution depth. l. Video snapshot of the RWIS area.		
RWI-110.3	OR-DWA-7, OR-DWA-5	CapTOP shall be able to provide a graphical trending plot report for any of the data identified in items c through o (see requirement directly above) for a user-specified RWIS station over a user-specified period of date/time interval.	2	Demo
RWI-110.4	SR-SYS-25	CapTOP shall provide a weather-related road condition report, over a specified time period, that provides the road name, weather data, and the date/time when the data was collected.	2	Demo
RWI-110.5	SR-SYS-25, UR-TO-22	CapTOP shall provide a weather-related warnings and closures report, over a specified time period, that provides weather data for the region, closures, and the date/time when the data was collected.	2	Demo
RWI-110.6	SR-SYS-22, SR-SYS-36, OR-DOC-4, IR-GUI-8	CapTOP shall be able to provide a full device configuration report for a user entered RWIS ID.	2	Demo
RWI-120	OR-DWA-7, OR-DWA-5	CapTOP shall be able to produce the following performance reports for evaluating the performance of RWISs, using data in the CapTOP operations and archived databases: a. Number of times a RWIS transitioned from online to offline over a specified time period; b. Number of times a RWIS transitioned from no device failure to device failure over a specified time period; c. Number of times a RWIS transitioned from no communication failure to communication failure over a specified time period.	2	Demo
RWI-130	OR-DWA-7, OW-DWA-5	CapTOP shall support an ad-hoc report generation capability that allows the user to build and specify their own queries based on data stored in RWIS related databases.	2	Demo
RWI-140	SR-SYS-22, SR-SYS-36,	CapTOP shall support the following capabilities for all reports:		Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
	OR-DOC-4, IR-GUI-8	a. be able to display all reports in a tabular format; b. be able to display graphical reports in a Microsoft Excel-like 2-dimensional or 3-dimensional format. c. be able to print all reports in landscape or portrait modes; d. include the report name and date generated on the header; e. support a template capability for each report, allowing the user to select which fields to display; f. include the page number on the footer.	a. 2 b. 2 c. 2 d. 2 e. 2 f. 2	

3.8.8.5 RWIS Logging Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-150	UR-TO-11, OR-TOM-1	CapTOP shall store and time stamp all operator and system activities that pertain to RWISs and provide the output in a time sequential log.	C	Demo
RWI-150.1	UR-TO-11, OR-C2F-3, OR-C2F-4, OR-DWA-13	CapTOP shall have the capability to automatically log the following user activities to the log database that pertain to RWISs: a. any operator-initiated action resulting in a request to access information; b. any operator-initiated action that attempts to, or results in, a change to a device; c. when the user changes the RWIS configuration data; d. operator login; e. operator logout. (Note: also refer to the LOG-* requirements).	C	Demo
RWI-150.2	UR-TO-11	CapTOP shall have the capability to automatically log the following system activities to the log database that pertain to RWISs: a. any system-initiated action that attempts to, or results in, a change to the device; b. when the communication station status changes (OK to failed, and failed to OK); c. changes in online-offline mode; d. software application login; e. software application logout; f. any transmitted alerts; g. database login; h. database logout. (Note: also refer to the LOG-* requirements).	1	Demo
RWI-150.3	UR-TO-11	CapTOP shall provide a window to display all logged system and user activities for RWISs.	1	Demo
RWI-150.4	UR-TO-11	CapTOP shall assign and store one of the following action types when logging all RWIS activities: a. operator input;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		b. operator command transmission (if applicable); c. operator informational message; d. operator error; e. system warning; f. system error; g. system information message; h. software application warning; i. software application error; j. software application information message.		
RWI-150.5	UR-TO-11	For log entries triggered by user actions, CapTOP shall log the following: a. Username; b. Date stamp; c. Time stamp; d. Workstation ID; e. Workstation IP address; f. Action type; g. Description of action (include the device ID, description of action, and summary status of device).	1	Demo
RWI-150.6	UR-TO-11	For log entries generated by the CapTOP applications, CapTOP shall log the following: a. Application name; b. Date stamp; c. Time stamp; d. Action type; e. Description of action.	1	Demo
RWI-150.7	UR-TO-11	CapTOP shall make all log entries read-only, changeable by only the System Administrator.	C	Demo
RWI-160	OR-DWA-5	CapTOP shall have the capability to query and retrieve all operator actions/commands that pertain to RWISs from the log by filtering on the following: a. Workstation ID; b. Workstation IP address; c. Username; d. Date stamp; e. Time stamp; f. Action type.	1	Demo
RWI-170	UR-TO-11, OR-DDM-16	CapTOP shall be capable of generating a system alert for the following: a. changes in communication station status (OK to failed, and failed to OK); b. changes in online-offline mode; c. changes to RWIS configuration data.	1	Demo

3.8.8.6 RWIS Archiving Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RWI-180	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		logged data that pertains to RWISs from the log database to the archived database.		
RWI-190	OR-DWA-13	CapTOP shall have the capability to format and perform automated and manually initiated migration of operations data that pertains to RWISs from the operations database to the archived database.	1	Demo

3.8.9 Regional Weather Interface Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
REW-10	OR-WEM-6	CapTOP shall provide access via the Web to regional weather reports, satellite and Doppler radar images, environmental condition data, and cloud coverage pictures from the following: a. National Weather Service (NWS); b. National Oceanic and Atmospheric Administration (NOAA); c. Weather.com d. *Clarus* data sources.	2	Demo
REW-20	OR-WEM-6	CapTOP shall provide access to the following data for both current and forecasted weather conditions: a. air temperatures; b. wind speed and direction; c. visibility; d. precipitation readings; e. atmospheric conditions.	2	Demo
REW-30	SR-SYS-24	CapTOP shall provide access to Regional Weather data to allow the TMC Operator to perform the following activities: a. deploy road maintenance resources; b. issue general traveler advisories; c. provide location specific weather and traffic warnings to drivers using the DMS/PDMS/HAR/Internet.	2	Demo
REW-30.1	OR-WEM-10, OR-WEM-11	CapTOP shall be able to display messages related to snow activities on DMS and PDMS during snow events.	2	Demo
REW-30.2	OR-WEM-10, OR-WEM-11	CapTOP shall be able to play messages related to snow activities on HAR during snow events.	2	Demo
REW-30.3	OR-WEM-10, OR-WEM-11	CapTOP shall be able to display messages related to adverse weather activities on the Internet during inclement weather events.	2	Demo

3.8.10 Video Switcher and Video Wall Integration

CapTOP's video switcher and video wall interface requirements are addressed in the CCTV section. Refer to the following requirements:

- CCT-20.2;
- CCT-350.2;
- CCT-340*.

3.8.11 Integration with Future IP Video Data

CapTOP's IP Video Data requirements are addressed in the CCTV section. Refer to the following requirements:

- CCT-80;
- CCT-340.2.

3.8.12 DDOT Web Interface

DDOT's Web Interface requirements are addressed in the section **Error! Reference source not found. Error! Reference source not found.**. Note: additional Web Interface requirements can be found in this document by performing a "find" and searching for "web-based".

3.8.13 UCC Interface

CapTOP shall support the UCC through the standard CapTOP Web-Interface available for remote users. CapTOP's UCC interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-80*;
- SYS-100.1;
- RTC-10;
- GUI-260*;
- INM-100.

3.8.14 DPW Interface

CapTOP shall support the DPW through the standard CapTOP Web-Interface available for remote users. CapTOP's DPW interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-80*;
- SYS-100.1;
- RTC-10;
- GUI-260*;
- INM-30.2.2.5.1;
- INM-30.2.2.5.2;
- SYS-80.

In addition, CapTOP shall meet the requirement below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
DPW-10	OR-CMM-5	CapTOP shall be able to disseminate traffic condition, incident, video, and roadway weather conditions to DPW to support maintenance and construction planning activities.	3	Demo

3.8.15 WMATA Interface

CapTOP shall support the WMATA interface through the standard CapTOP Web-Interface available for remote users as well as bidirectional exchange of data related to special events and incidents. CapTOP's WMATA interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-80*;
- SYS-100.1;
- RTC-10;
- GUI-120.1.1;
- GUI-260*;
- INM-100;
- INM-100.5;
- INM-100.6;
- INM-100.7.

3.8.16 MPD and United States Capitol Police Interface

CapTOP shall support the MPD and Capitol Police through the standard CapTOP Web-Interface available for remote users. CapTOP's MPD and Capitol Police interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-140;
- INM-100.7;
- INM-110;
- INM-300;
- INM-310;
- INM-520.

In addition, CapTOP shall meet the requirement below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
MPD-20	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 DDOT ITS devices under the control of the Capitol Police.	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
MDP-30	OR-MMC-8	CapTOP shall display roadway blockages and MPD preempted signals at pop-up barrier/delineator locations.	3	Demo

3.8.17 Fire/Rescue Interface

No specific CapTOP requirements were identified that were specific to the fire/rescue departments. However, CapTOP shall support the fire/rescue departments through the standard CapTOP Web-Interface available for remote users. Refer to the following requirements:

- SYS-80*;
- SYS-100.1;
- RTC-10;
- GUI-260*.

3.8.18 Homeland Security/EMA (HSEMA) Interface

CapTOP shall support HSEMA through the standard CapTOP Web-Interface available for remote users. Refer to the following requirements:

- SYS-80*;
- GUI-260*.

In addition, CapTOP shall meet the requirements below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HSE-10	OR-EM-5	CapTOP shall provide the following information to HSEMA 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	Demo
HSE-20	OR-EM-1	CapTOP shall provide an electronic interface with the HSEMA to exchange evacuation information and display evacuation routes on the CapTOP map display.	1	Demo
HSE-30	OR-EM-2	CapTOP shall provide an electronic interface with the HSEMA to implement traffic control strategies to	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		support evacuation plans, changes in traffic patterns for special events, and weather-based incidents.		
HSE-40	OR-EM-3	CapTOP shall provide an interface with the HSEMA to receive the following information from emergency management responders: a. location; b. type of incident; c. severity of incident; d. incident duration.	1	Demo

3.8.19 Video Aircraft Downlink Interface

FRD Req ID	ORD Req ID	Description	Priority	Test Method
VAD-10	SR-SYS-28	CapTOP shall provide the ability to receive and display video downlink data from aircrafts.	3	Demo
VAD-10.1	SR-SYS-28	CapTOP shall provide the ability to display the down linked video on any TMC monitor that is able to display video from traffic cameras.	3	Demo

3.8.20 Parking Management Interface

CapTOP's Parking Management Interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-80;
- GUI-260

In addition, CapTOP shall meet the requirements below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
PAM-10	N/A	CapTOP shall provide an interface with the Parking Management System to provide traffic volume information.	3	Demo
PAM-20	N/A	CapTOP shall provide an interface with the Parking Management System to accept parking availability information.	3	Demo
PAM-30	N/A	CapTOP shall display parking availability information for special events via channels accessible by the public including websites, HAR, DMS, and commercial media.	3	Demo
PAM-40	N/A	CapTOP shall interface with the Parking Management System using a Web-based interface.	2	Demo

3.9 Regional C2C Requirements

3.9.1 Real-Time Video/Data Sharing

CapTOP's real-time video/data sharing functional requirements are addressed in various sections. Refer to the following requirements:

- SYS-70;
- SYS-80*;
- SYS-100.1;
- RTC-10;
- GUI-260*;
- INM-100.

In addition, CapTOP shall meet the requirements below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RTC-10	OR-C2C-2, OR-RTC-1	CapTOP shall provide a "generic" standardized 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.	C	Demo
RTC-10.1	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	Demo
RTC-10.2	OR-EM-4	CapTOP shall be able to send video images to emergency management responders and other dispatch centers to aid with dispatch.	1	Demo
RTC-10.2.1	OR-RTC-6	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	Demo
RTC-10.3	OR-RTC-10	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	Demo
RTC-10.4	OR-RTC-11	CapTOP shall support integrated regional traffic	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		control coordination on surface streets in VA, MD, and DC through coordinated signal, DMS, PDMS and HAR control, and incident and video sharing. Also refer to RTC-10.5.		
RTC-10.4.1	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.	2	Demo
RTC-10.5	OR-RTC-12	CapTOP shall support integrated regional traffic control coordination on freeways in VA, MD, and DC through coordinated messages on DMS, PDMS, and HAR, and incident and video sharing.	2	Demo
RTC-10.5.1	OR-RTC-2	CapTOP shall provide an electronic interface with the NOVA OpenTMS to request DMS and HAR coordinated messages.	3	Demo
RTC-10.5.2	OR-RTC-3	CapTOP shall provide an electronic interface with the SHA's CHART system to request DMS and HAR coordinated messages.	3	Demo
RTC-10.5.3	OR-RTC-5	CapTOP shall provide the TMC Operator with the following electronic notification methods 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	Demo
RTC-10.5.4	OR-RTC-4	CapTOP shall provide the TMC Operator with the following electronic notification methods 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	Demo
RTC-10.5.5	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	Demo
RTC-10.5.5.1	OR-RTC-7	CapTOP shall be able to disseminate traveler information about incidents (including special events) and traffic conditions to roadway users who are approaching DC by cooperating with the following neighboring jurisdictions: a. SHA; b. VDOT.	1	Demo
RTC-10.6	OR-RTC-13	CapTOP shall be able to share the equipment status from the following devices with external agencies: a. traffic signals;	2	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		b. CCTV cameras; c. DMS; d. PDMS; e. HAR; f. RWIS; g. traffic detection stations; h. WIM stations; i. permanent count stations.		
RTC-10.7	OR-RTC-14	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	Demo

3.9.2 Agency Interfaces

3.9.2.1 RITIS Interface

CapTOP's RITIS interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-70;
- SYS-80*;
- SYS-100.1;
- GUI-260*;
- INM-100;
- RTC-10;
- RTC-40;
- RTC-50.

In addition, CapTOP shall meet the requirement below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RTC-20	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;	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		l. weather-related road conditions; m. weather-related warnings; n. weather-related closures.		

3.9.2.2 511 Interface

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RTC-30	OR-RTC-8	CapTOP shall communicate with the region's 511 system via RITIS for exchanging traffic/incident information. Note: DDOT does not require a direct interface with the 511 system. The interface with 511 is indirect and through RITIS. This is subject to be re-evaluated at a later date.	1	Demo

3.9.2.3 INRIX Interface

For CapTOP's INRIX interface requirements refer to the following:

- GUI-170;
- TDA-10.1.

In addition, CapTOP shall meet the requirement below.

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RTC-40	SR-SYS-38	CapTOP shall interface with the INRIX data server to obtain the following real-time data, every 2 minutes, for freeways and arterials in the D.C. region: a. average speed. b. free flow speed; c. travel time data with confidence levels.	C	Demo
RTC-40.1	SR-SYS-38	CapTOP shall provide a monitoring interface to the existing INRIX data server through CapTOP's new traffic data server. Refer to TDA-10* for more information.	C	Demo
RTC-40.2	SR-SYS-38	CapTOP's Traffic Data Server (developed by others, or optionally, by the CapTOP developer) shall interface with the INRIX data server to obtain real-time speed and travel time data.	C	Demo

3.9.2.4 CAPWIN Interface

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RTC-50	OR-RTC-8	CapTOP shall communicate with CapWIN via RITIS for exchanging traffic/incident information.	1	Demo

FRD Req ID	ORD Req ID	Description	Priority	Test Method
		Note: DDOT does not require a direct interface with the CAPWIN system. The interface with CAPWIN is indirect and through RITIS. This is subject to be re-evaluated at a later date.		

3.9.2.5 CHART Interface

CapTOP's CHART interface requirements are addressed in various sections. Refer to the following requirements:

- SYS-80*;
- SYS-100.1;
- RTC-10;
- GUI-260*;
- INM-100;
- INM-160.2.6.

3.9.2.6 RICCS Interface

FRD Req ID	ORD Req ID	Description	Priority	Test Method
RTC-60	OR-RTC-8	CapTOP shall communicate with RICCS via RITIS for exchanging traffic/incident information (not a direct RICCS interface).	1	Demo

3.9.2.7 VDOT NOVA Interface

CapTOP's interface requirements to the VDOT OpenTMS system are addressed in various sections. Refer to the following requirements:

SYS-80*;
SYS-100.1;
GUI-260*;
RTC-10;
INM-100;
INM-160.2.6.

3.10 Legacy Interface Requirement

Refer to each subsystem for details on any relevant legacy interface requirements.

3.11 Security Requirements

3.11.1 Workstation and Server Security

Refer to the GUI-330* requirements.

3.11.2 Users and Groups Privileges

Refer to the GUI-340* requirements.

3.11.3 DDOT Web Security

CapTOP's Web security requirements are addressed in various sections. Refer to the following requirements:

- INM-550;
- INM-560;
- GUI-240*;
- HWR-10;
- HWR-20.

3.12 Hardware Requirements

FRD Req ID	ORD Req ID	Description	Priority	Test Method
HWR-10	SR-SYS-1	The Contractor is required to provide all workstation, server, and communication hardware to host all Contractor software and to provide a fully operational CapTOP system at both the Primary and Backup TMCs.	1	Demo
HWR-10.1	SR-SYS-1	The Contractor is required to provide one (1) primary and one (1) redundant server of each type (CapTOP Server, Application Server, Database Server, Web Server, Communication Server, Video Server). Note: Application Servers are needed for Signals, CCTV, HAR, DMS, Video, and Traffic Data. Refer to FIGURE 2 CapTOP Hardware Architecture.	1	Demo
HWR-10.2	SR-SYS-1	The Contractor is required to provide five (5) workstations at the Primary and Backup TMCs.	1	Demo
HWR-20	SR-SYS-1	OITI will provide all network switches as government furnished equipment to the Contractor.	1	Demo
HWR-30	SR-SYS-1	OITI will provide patch and virus scan all Contractor-provided equipment prior to installation on the DDOT network.	1	Demo
HWR-30.1	SR-SYS-1	All software must be able to execute properly with an active virus scan running.	1	Demo

3.13 General Warranty

(1) The Contractor warrants that, at the time of completion and acceptance, the work performed under the Contract conforms to the Contract requirements; was performed in a good, workmanlike manner; and is free of defects in design, materials, equipment, and workmanship.

(2) The Contractor warrants that for the full term of the Contract, (including options) the work performed under this Contract will conform to the Contract requirements and will be free of defects.

(3) The Contractor warrants that the system, its design, and each of its components, including all hardware and software, are suitable for their intended purposes as an integrated, and fully functioning Advanced Traffic Management System (ATMS); and that, in all other respects, it shall conform to the Contract requirements and design objectives set forth in this FRD. The Contractor further warrants that neither the system nor any component thereof infringes upon or violates any patent, copyright, trade secret, or proprietary right of any other party.

(4) With respect to the work performed by or obtained from others, the Contractor shall obtain and cause its subcontractors and suppliers to obtain, at a minimum, all expressed and implied warranties that would be given in normal commercial practice; require such warranties to be executed for the benefit of the DDOT; and, if directed by the Procurement Officer, enforce such warranties for the benefit of the DDOT.

(5) The warranties herein and the rights and remedies of the DDOT relative thereto are in addition to all warranties, rights, and remedies available at law or in equity or elsewhere under this Contract.

3.14 Correction of Defects

(1) For a period of three (3) years after acceptance, or for the full term of the Contract, (including options), whichever is longer, the DDOT will require the Contractor to correct any defect in the work or to remedy damage to property, real or personal, at or adjacent to a site, if the damage is the result of the Contractor's failure to conform to Contract requirements, or of a defect in the work or the design for the work. Correction shall include, without limitation, removal and replacement and all other work necessary to correct the defect or remedy the damage.

(2) The rights and remedies of the DDOT under this clause are in addition to those available at law or elsewhere in this Contract.

3.15 Failure to Maintain Entire Project

Failure on the part of the Contractor, at any time, to meet the FRD requirements, will result in the Procurement Officer's immediately notifying the Contractor to comply with the required provisions. In the event that the Contractor fails to correct the compliance issues within one (1) month after receipt of such notice, the Procurement Officer may notify the contractor to suspend all other work on the contract until such time as the unsatisfactory items are corrected. In the event that the Contractor fails to respond to unsatisfactory items within one (1) month after receipt of such notice, the Procurement Officer may cancel the contract.

3.16 Software Licenses

(a) DEFINITIONS

Custom Code – shall be any program, script, firmware, software, application, data, protocol, encoding algorithm, or other piece of intellectual property, in whole or in part, meeting any one of the following conditions:

(1) Developed or created by the Contractor, subcontractors, subcontractors to subcontractors, etc., specifically to satisfy the requirements of this project.
(2) Not commercially available on the open market as a "shrink wrapped" package, unless specifically agreed to in writing prior to the execution of this Contract.

COTS – Commercial-Off-The-Shelf. For software, this means a software package that can be purchased on the open market in a 'shrink-wrapped' package. Such a product would have widespread use in many industries for common needs. Examples of COTS products might include, but not be limited to, operating systems, MPEG-2 decoders, office applications such as word processors, spreadsheets, relational databases, Internet browsers, or e-mail applications.

Licensee – The DDOT.

Licensor – The Contractor.

Software – Any set of instructions, procedures or protocols that are documented, are processed by computer, and which operate or provide functionality to any feature of the project. It is the intent of the DDOT that this definition be broad and inclusive.

(b) The ATMS software shall be considered COTS products for this project. Any DDOT-specific algorithms, reports, client applications, or user interface code developed for this project shall be considered custom code for this project.

(c) COTS PRODUCTS

The Contractor shall provide a valid license agreement for all COTS products. The license MUST be suitable for use on this project. The Contractor is responsible for determining that the use of the COTS products does not violate the license agreements for those products.

The DDOT shall be responsible for licensing third party products on any additional computers within the DDOT not covered in the original Contract.

COTS license agreements shall not be considered a material change to the specifications and requirements of the Contract. The Contractor shall remain responsible to provide a system that functions as specified in the FRD.

COTS license agreements shall not require periodic, one-time, or other payment by the DDOT directly to any third party. All costs shall be included in the Contract payments to the Contractor.

COTS license agreements shall not contain self-termination clauses based on date or time, future payments, or any other condition.

(d) CUSTOM CODE – Desired License Terms and Conditions

(1) The DDOT shall be granted non-exclusive license to use the Custom Code on any number of computers, for any purpose that in the DDOT's opinion, is beneficial to the DDOT.
(2) The DDOT shall have a non-exclusive license to the source code, object code, firmware, executables, and all associated makefiles, resource files, data files, documentation, diagrams, and project files.
(3) The Contractor's development tools must be Commercial-Off-the-Shelf Software (i.e., available from distributors not affiliated with or related to the Contractor and not subcontracted for this project). Where the Contractor has used any other development tools, a copy thereof shall be included in the deliverables; and the DDOT, or its designated representative, shall be granted a license to use said development tools in conjunction with software maintenance, support, enhancement, or modification.
(4) The DDOT shall not sell the source, object or any other custom code provided for this project. The DDOT shall not transfer the source, object, or any other custom code to any other party except as needed for the continuous maintenance and use of the DDOT's CapTOP system and subject to the non-disclosure agreement.
(5) A copy of the source code, object code, firmware, executables, and all associated makefiles, resource files, data files, and project files, shall be delivered to the DDOT − on CD ROM or other approved media − upon completion of each major milestone and prior to payment for those milestones.
(6) The DDOT shall own any and all changes that it makes or those made by third parties that the DDOT engages to make such changes.

(e) CUSTOM CODE – Required License Terms and Conditions

(1) Any changes, modifications, enhancements, or derivative works performed by the Contractor for the DDOT are included in the license agreement as if supplied in the original software. This provision shall apply to all extra work orders. No new license agreements shall be required for changes, additions, modifications, upgrades, or other work on this project.
(2) License agreements shall not alter, supersede, change, or modify any of the terms, conditions, or requirements of the Contract.

(3) Any license agreements, or other statements, in writing or within the software program, which contain language contrary to the contract documents, shall be unacceptable and not binding in any way on the DDOT.

(4) Upon completion of the Contract, including any option years, the DDOT shall have the right to contract for services to maintain and operate the software, including, but not limited to, modifying the source code or configuration, changing database schema, and integrating with other systems. The DDOT agrees to require that any other parties involved in maintenance or modification of the source or object files enter into a non-disclosure agreement prior to having access to the source or object files.

(f) COPY PROTECTION

(1) The DDOT does not encourage the use of copy protection schemes in the software. This software is intended to serve public interests and transportation controls functions of the DDOT. Thus, ANY programming that further complicates or potentially could disrupt the operation of the software is strongly discouraged. However, based on the Contractor's desire to protect marketable software from piracy, copy protection schemes will be accepted only where the Contractor assumes complete liability in the event that such schemes cause failure or disruption of the use of the software. The implementation of any copy protection scheme shall be considered acceptance of these terms and conditions.

(2) A failure of a copy protection scheme shall be defined as any event where the software is not accessible, fails to perform a required function, or otherwise does not properly function as a result of a copy protection scheme. The Contractor shall be liable for such failures. Liability shall include liability for actual, incidental and consequential damages including, but not limited to:

a. Man-hours expended to remedy or work around software failures caused by copy protection schemes.

b. Where public safety is compromised and injuries or property damage result and can be linked to the software failure, in whole or in part, the Contractor shall be completely liable for such damages or portion thereof attributed to the failure.

c. Any loss of revenue.

(3) Software locks − which require (a) verification numbers, license numbers, or other Contractor- or vendor-provided information; and (b) renewal or periodic update − shall be updated by the Contractor or his representative whenever necessary. The Contractor is required to visit the site at the appropriate intervals and update the information. At no time shall DDOT employees be involved in this process. Remote access to the computer systems is prohibited.

(4) The software locks/codes shall be provided to the DDOT in the event that hardware or reinstallation of the software is necessary.

(5) The Contractor shall respond to any issues related to software locks that are based on hardware hashing or dongles within two (2) hours from the time of notice, twenty-four (24) hours per day, seven (7) days per week, in perpetuity. These locks prevent the use of software except on pre-authorized computers

based on information contained within the hardware of the computer. When DDOT staff installs repaired or replacement parts, the Contractor shall, within two (2) hours, visit the site and update the software locks such that the software is functional. The use of these devices, especially dongles, is strongly discouraged by the DDOT. The Contractor is required to notify the DDOT in writing if any software uses such devices.

(6) Where continued or persistent problems develop with copy protection schemes, and the DDOT determines that significant public safety concerns exist, the DDOT may direct the Contractor to remove such schemes completely at the Contractor's own expense.

(7) If software locks are used based on hardware hashing or license keys that are machine dependent, or require interaction with the COTS vendor to obtain a valid software key, the DDOT will require the COTS vendor to establish a software escrow at their expense. The software escrow shall hold all source code, executables, libraries, and documentation needed to provide a valid key in the event the DDOT transfers the software from one machine to another. This escrow is to protect the DDOT from the COTS vendor in the event the vendor goes out of business. Alternatively, the COTS vendor may provide to the DDOT all executable codes needed to produce a valid software key.

3.17 Software Warranty

(1) This software warranty is in addition to any warranty requirements of the contract that may also apply to software.

(2) The Contractor represents and warrants that the system functions correctly with respect to date and time over any date and time, and any date and time field, between 12:00:00 AM January 1, 1990 and 11:59:59 PM December 31, 2099.

(3) The Contractor represents and warrants that the system does not infringe on any patent, copyright, trademark, or trade secret or other proprietary right of any person or organization.

(4) Warranty of Title

a. The Contractor shall warrant that it has full title and ownership of the software. The Contractor shall further warrant that it has the power and DDOT to grant license to the DDOT as stated herein and that said license will in no way constitute an infringement on or other violation of any copyright, trade secret, trademark, patent or other proprietary right of any third party.

b. Indemnification

i. The Contractor agrees to indemnify and hold harmless Licensee and its affiliates arising out of, or related to, any claim that Licensee's use or possession of the software or documentation, or the license granted hereunder, infringes on or violates the copyright, trade secret, patent, trade mark, service mark, or other proprietary right of any third party.

ii. Licensor shall defend and settle, at its sole expense, all suits or proceedings arising out of the foregoing. No settlement that prevents the Licensee from continuing to use the software, or which modifies the license agreement, shall be made without the Licensee's prior

written consent. In all events, Licensee shall have the right to participate at its own expense in the defense of any such suit proceeding through counsel of its own choosing.

(5) Termination and Default
   a. Should the Contractor, for any reason, be unable to complete the project, honor the warranty, or provide software maintenance, at any time during the operating life of the software, or prior to delivery of the software, the DDOT shall be granted ownership of the software and all source code.
   b. Should the DDOT, for any reason, breach its responsibility under the license agreement, the Contractor's remedial action shall be limited to monetary damages. The software performs critical traffic control functions for the DDOT and the Contractor shall not deny the DDOT access to the software, for any reason, by injunctive or other means.
   c. This license agreement shall remain in effect in perpetuity.
   d. This license is non-terminable. Should the Contractor desire to terminate the license then all software, copyrights, trade secrets, and patents shall be assigned to the DDOT by the Contractor or other owners of the software.

(6) The effective date of license shall be the date the Contract is executed (signed by all parties).

3.18 Qualification Test Requirements for Final Product Acceptance

The Contractor shall perform the necessary steps to successfully accomplish acceptance testing as described below.

The Contractor shall supply a test procedure submittal to the DDOT for approval. There shall be one test procedure for each functional area and/or subsystem, each with multiple tests. The test procedure must be detailed, step-by-step, and provide testing of all functional requirements. A testing traceability matrix shall be required that maps each test procedure to the requirements in this specification. A written test procedure must be provided to the DDOT for approval prior to execution, and after execution signed by the tester and a DDOT witness. The Contractor shall conduct tests to verify compliance with the Contract Documents and all requirements. The Contractor shall provide a requirement-traceability matrix for each test. The matrix shall clearly identify what functionality is being tested and the applicable section(s) in the FRD. All equipment furnished by the Contractor shall be subject to monitoring and testing to determine conformance with all applicable requirements and to ensure the proper operation of the equipment and system.

The Contractor shall supply all equipment required for conducting the tests. If any component or material used in the construction of the system is defective or otherwise unsuitable, or the workmanship does not conform to the accepted standards, the Contractor shall replace such defective parts and materials at no cost to the DDOT.

3.19 Training

The Contractor shall provide training courses to the DDOT for the CapTOP system. The training shall include how to operate, maintain, and trouble shoot the system. A training submittal shall

be submitted for approval 30 days prior to performing any training. The DDOT must approve the training material in advance of the training. Copies of all approved training materials must be provided by the Contractor to all trainees. The Contractor shall provide an operator training class and a separate class for maintenance training. All training materials shall provide detailed step-by-step instructions for trainees. Standard off-the-shelf reference manuals may be used, but tailored step-by-step procedures and exercises must be provided during training to place emphasis on those features that will be utilized by DDOT. Under no circumstances shall generic training be required. The training must be specific to the DDOT's configuration.

The Contractor shall perform the following training tasks:

I. The Contractor shall conduct two (2), 1-day maintenance, system administrator and troubleshooting training classes for up to 10 maintenance technicians at a DDOT to be named facility. The 1st training class will be conducted within 1 week of successful acceptance testing of the system. The last training class will be conducted as a make-up or refresher class on an as-needed basis;

   The training shall cover module replacement, programming, configuration, troubleshooting, testing, and other items as necessary to maintain the CapTOP system in operational condition. Training must be provided to the DDOT to allow DDOT personnel to configure/program/enable any programmable capability provided by the system. The Contractor shall supply copies of a maintenance manual complete with catalog cuts of all parts and components utilized within the system, including user manuals, and installation and configuration guides. Detailed procedures providing step-by-step instructions for configuring and maintaining the system shall be provided along with the training materials. Exercises shall be provided for all system administrator and maintenance functions. The Contractor shall include this information in the training package for each trainee. All information shall be bound in a 3 ring binder with an outside label on the binder cover and spine. In addition to each trainee receiving a copy of this binder, one full copy of the binder shall be left in the DDOT TMC. This manual is for use by the TMC Manager and Maintenance Technicians and must contain all information necessary to repair/reinstall/reprogram any aspect of the system.

II. In addition to the above, the Contractor shall provide two (2) 1-day operator training classes for up to 10 operators. At a DDOT to be named facility. The 1st training class will be conducted within 2 days of successful acceptance testing of the system. The last training class will be conducted as a make-up or refresher class when needed

   The training shall cover all user functions in the system. Training must be provided to the DDOT to allow DDOT personnel to operate the CapTOP system. The Contractor shall supply copies of a maintenance manual complete with catalog cuts of all parts and components utilized within the system, including user manuals, and installation and configuration guides. Detailed procedures providing step-by-step instructions for operating the system shall be provided along with the training materials. Exercises shall be provided for all operator functions. The Contractor shall include this information in the training package for each trainee. All information shall be bound in a 3 ring binder

with an outside label on the binder cover and spine. In addition to each trainee receiving a copy of this binder, one full copy of the binder shall be left in the DDOT TMC. This manual is for use by the TMC Operators and must contain all information necessary to operate any aspect of the system.

4. NATIONAL ITS ARCHITECTURE CONSISTENCY

4.1 Introduction

FHWA Rule 940.11/FTA Policy Section VI requires all ITS projects, which use federal funds, to conform to the National ITS Architecture. In case of a non-existent regional ITS architecture, the relevant portion of the National ITS Architecture that are to be implemented by the project must be identified, as shown in FIGURE 4, Article 940.11(c)(1). This section provides the details of how the envisioned CapTOP system architecture satisfies this conformance requirement.

§ 940.11 Project implementation.

(a) All ITS projects funded with highway trust funds shall be based on a systems engineering analysis.

(b) The analysis should be on a scale commensurate with the project scope.

(c) The systems engineering analysis shall include, at a minimum:

(1) Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS Architecture);
(2) Identification of participating agencies roles and responsibilities;
(3) Requirements definitions;
(4) Analysis of alternative system configurations and technology options to meet requirements;
(5) Procurement options;
(6) Identification of applicable ITS standards and testing procedures; and
(7) Procedures and resources necessary for operations and management of the system.

(d) Upon completion of the regional ITS architecture required in §§ 940.9(b) or 940.9(c), the final design of all ITS projects funded with highway trust funds shall accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. If the final design of the ITS project is inconsistent with the regional ITS architecture, then the regional ITS architecture shall be updated as provided in the process defined in § 940.9(f) to reflect the changes.

(e) Prior to the completion of the regional ITS architecture, any major ITS project funded with highway trust funds that advances to final design shall have a project level ITS architecture that is coordinated with the development of the regional ITS architecture. The final design of the major ITS project shall accommodate the interface requirements and information exchanges as specified in this project level ITS architecture. If the project final design is inconsistent with the project level ITS architecture, then the project level ITS architecture shall be updated to reflect the changes.

The project level ITS architecture is based on the results of the systems engineering analysis, and includes the following:

(1) A description of the scope of the ITS project;
(2) An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the ITS project;
(3) Functional requirements of the ITS project;
(4) Interface requirements and information exchanges between the ITS project and other planned and existing systems and subsystems; and
(5) Identification of applicable ITS standards.

(f) All ITS projects funded with highway trust funds shall use applicable ITS standards and interoperability tests that have been officially adopted through rulemaking by the DOT.

(g) Any ITS project that has advanced to final design by February 7, 2001 is exempt from the requirements of paragraphs (d) through (f) of this section.

FIGURE 4 Federal Rule-Making for Architecture Consistency

The District of Columbia does not have an established and maintained regional ITS architecture. Therefore, for the CapTOP System, its conformity was looked at with respect to the National ITS Architecture. The national architecture document is accessible at the following URL:

http://www.iteris.com/itsarch/

4.2 Conformity Assessment

The Federal regulation calls for the identification of the portions of the National (or regional) ITS Architecture that will be implemented through the planned/designed system. Therefore, it is necessary to explore how the envisioned CapTOP Central System fits within with the National Architecture framework. For establishing the conformity of the CapTOP Central System with the National Architecture, the CapTOP functionalities are broadly divided into two groups, which are addressed separately in this section. First, the CapTOP Central system primarily represents interfaces with and/or control or management of external entities (e.g., field equipment, other system/agencies and users). Second, besides the interface/management capabilities, the CapTOP Central System embeds additional functionalities as necessary to support its various subsystems.

To address the interface/control/management capabilities, a mapping was established between the CapTOP Central System's interfaces (for External Entities), as depicted in the system Context Diagram (refer to FIGURE 1 Context Diagram for CapTOP System), to the National Architecture market packages. TABLE 10 presents the mapping by identifying the relevant equipment packages (both at the External Entity end and at the CapTOP Central System end) and the supporting market packages. This mapping indicates that CapTOP Central System interfaces are within the framework of the National Architecture.

TABLE 10 Traceability of CapTOP System to National ITS Architecture

Item No.	External Interface				CapTOP Central System		Supporting Market Package
	Element	**Type of Element in National Architecture**	**Subsystem/ Terminator Name**	**Relevant Equipment Package (for Interface to CapTOP Central System)**	**National Architecture Subsystem**	**Relevant Equipment Package(s)**	
1	Highway Advisory Radio	Subsystem	Roadway	Roadway Traffic Information Dissemination	Traffic Management	TMC Traffic Information Dissemination	ATMS06 - Traffic Information Dissemination
2	ATC Signal System (Future)	Subsystem	Roadway	Roadway Basic Surveillance Roadway Signal Controls	Traffic Management	Collect Traffic Surveillance TMC Signal Control Traffic Maintenance	ATMS03-Surface Street Control
3	170E Signal System	Subsystem	Roadway	Roadway Basic Surveillance Roadway Signal Controls	Traffic Management	Collect Traffic Surveillance TMC Signal Control Traffic Maintenance	ATMS03-Surface Street Control
4	RWIS	Subsystem	Roadway	Roadway Environmental Monitoring	Traffic Management	TMC Environmental Monitoring	MC03-Roadway weather Data Collection
5	Portable DMS	Subsystem	Roadway	Roadway Traffic Information Dissemination	Traffic Management	TMC Traffic Information Dissemination	ATMS06 - Traffic Information Dissemination
6	Stationary DMS	Subsystem	Roadway	Roadway Traffic Information Dissemination	Traffic Management	TMC Traffic Information Dissemination	ATMS06 - Traffic Information Dissemination
7	Close Circuit Television	Subsystem	Roadway	Roadway Basic Surveillance	Traffic Management	Collect Traffic Surveillance Traffic Maintenance	ATMS01-Network Surveillance
8	TMC Operators	Terminator	Traffic Operations Personnel	N/A	N/A	N/A	N/A

Item No.	External Interface				CapTOP Central System		Supporting Market Package
	Element	**Type of Element in National Architecture**	**Subsystem/ Terminator Name**	**Relevant Equipment Package (for Interface to CapTOP Central System)**	**National Architecture Subsystem**	**Relevant Equipment Package(s)**	
9	TE Operations Specialists	Terminator	Traffic Operations Personnel	N/A	N/A	N/A	N/A
10	Vehicle Detectors	Subsystem	Roadway	Roadway Basic Surveillance	Traffic Management	Collect Traffic Surveillance Traffic Maintenance	ATMS01-Network Surveillance
11	Trouble Ticket Management (Hansen)	Terminator	Asset Management	N/A	Traffic Management	Traffic Maintenance	MC07-Roadway Maintenance and Construction
12	Video Downlink (from Aircraft)	Subsystem	Roadway (Special Case)	Roadway Basic Surveillance	Traffic Management	Collect Traffic Surveillance	ATMS01-Network Surveillance (Special Case)
13	WMATA	Subsystem	Transit Management	Transit Center Multi-Modal Coordination	Traffic Management	TMC Multimodal Coordination	APTS07-Multi-modal Coordination
14	VDOT NRO/STC	Subsystem	Traffic Management	TMC Regional Traffic Management	Traffic Management	TMC Regional Traffic Management	ATMS07-Regional Traffic Management
15	Alerting Systems (Public emergency notifications, WASA, NAWAS)	Subsystem	Information Service Provider (Special case)	ISP Operational Data Repository	Traffic Management	TMC Transportation Operations Data Collection	ATIS06-Transportation Operations Data Sharing
16	CVISN	Subsystem	Commercial Vehicle Check Subsystem	Roadside WIM (a)	Traffic Management	Collect Traffic Surveillance (b)	CVO06-Weigh-In-Motion (a) ATMS01-Network Surveillance (b)

Item No.	External Interface				CapTOP Central System		Supporting Market Package
	Element	**Type of Element in National Architecture**	**Subsystem/ Terminator Name**	**Relevant Equipment Package (for Interface to CapTOP Central System)**	**National Architecture Subsystem**	**Relevant Equipment Package(s)**	
17	INRIX	Subsystem	Information Service Provider	ISP Operational Data Repository	Traffic Management	TMC Transportation Operations Data Collection	ATIS06-Transportation Operations Data Sharing
18	Roadway Operations Patrol	Subsystem	Emergency Vehicle	On-board EV En Route Support On-board EV Incident Management Communication	Emergency Management	Service Patrol Management	EM04-Roadway Service Patrols
19	NCR Emergency Response	Terminator	Other Traffic Management	N/A	Traffic Management	TMC Incident Dispatch Coordination/Communication	ATMS08-Traffic Incident Management System
20	Public Safety	Subsystem	Emergency Management	Incident Command	Traffic Management	TMC Incident Dispatch Coordination/Communication	ATMS08-Traffic Incident Management System
21	CHART	Subsystem	Traffic Management	TMC Regional Traffic Management	Traffic Management	TMC Regional Traffic Management	ATMS07-Regional Traffic Management
22	DC Unified Communications	Subsystem	Emergency Management	Incident Command	Traffic Management	TMC Incident Dispatch Coordination/Communication	ATMS08-Traffic Incident Management System
23	Web Services	Subsystem	Information Service Provider	ISP Traveler Data Collection	Traffic Management	Collect Traffic Surveillance	ATIS02-Interactive Traveler Information

Item No.	External Interface				CapTOP Central System		Supporting Market Package
	Element	**Type of Element in National Architecture**	**Subsystem/ Terminator Name**	**Relevant Equipment Package (for Interface to CapTOP Central System)**	**National Architecture Subsystem**	**Relevant Equipment Package(s)**	
24	511	Subsystem	Information Service Provider	ISP Traveler Data Collection (a)	Traffic Management	Collect Traffic Surveillance (b)	(a) ATMS01 - Network Surveillance (b) ATIS10-VII Traveler Information
25	Snow Operations	Subsystem	Maintenance and Construction Management	MCM Winter Maintenance Management	Traffic Management	TMC Incident Dispatch Coordination/Communication	MC06-Winter Maintenance
26	CIPS	Subsystem	Roadway (a) Traffic Management (b)	Roadway Basic Surveillance (a) Incident Detection (b)	Traffic Management	Collect Traffic Surveillance (a) Traffic Maintenance (a)	ATMS01-Network Surveillance (a) ATMS08-Traffic Incident Management System (b)
27	RITIS	Subsystem	Traffic Management	TMC Regional Traffic Management	Traffic Management	TMC Regional Traffic Management	ATMS07-Regional Traffic Management
28	Service Request & Task Order System (CityWorks)	Terminator	Asset Management	N/A	Traffic Management	Traffic Maintenance	MC07-Roadway Maintenance and Construction

As indicated earlier, the CapTOP Central System has additional internal functionalities, most of which are support functions for the capabilities noted in TABLE 10. TABLE 11 lists these additional functions and establishes mapping to National Architecture, as appropriate. This exercise also shows that these functionalities are within the framework of the National ITS Architecture.

TABLE 11 Mapping of CapTOP Central System's Supplemental Functionalities to ITS National Architecture

Item No.	CapTOP Central System Supplemental Functionalities	Relevant National Architecture Subsystem	Relevant Equipment Package	Supporting Market Package
1	Data archiving	Traffic Management	Traffic Data Collection	AD1-ITS Data Mart
2	Other database functions	Support	N/A	N/A
3	Graphic user interface	Support	N/A	N/A
4	System configuration	Support	N/A	N/A
5	System support functions	Support	N/A	N/A

The above exercise demonstrates that the envisioned CapTOP Central System documented in this report is fully traceable to the ITS National Architecture framework, and therefore, it is compliant with the Federal requirements for conformity.