

System Requirements for the City of Houston Intelligent Transportation System (HITS)

Version 1.0

A Project by the City of Houston, Texas



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Section 1. Introduction

This System Requirements Specification (SRS) document summarizes the requirements for the Houston Intelligent Transportation System (HITS) deployment. The SRS describes what the HITS system is to do by specifying functional requirements and how it should perform by specifying performance requirements.

The SRS is not intended to define how the HITS system is to be built. That will be completed in the detailed design documents developed by the consultant chosen after the design-build procurement of a project team.

The SRS formulates the HITS system requirements using the framework of the Concept of Operations as well as known constraints. The SRS also documents the scope of the system to be developed and provides documentation to be used later in the verification and testing of the HITS system.

1.1 Purpose

The HITS initiative is an effort to generate and disseminate City of Houston arterial transportation system information for the benefit of transportation managers & operators and users of major arterial roadway facilities within the city. The purpose of the HITS system is to enhance the capabilities of the city to do the following:

- Enable traffic management staff to detect abnormal network conditions so that they may use central control to optimize operations by changing signal timing plans under various conditions;
- Provide operational visibility to enable traffic management staff to detect and respond to congestion and incidents in near-real time;
- Provide real-time traveler information to the public, partner agencies, and media outlets for use and dissemination;
- Provide data for post-event analysis, TSM&O improvements, and long-term planning efforts; and
- Allow maintenance staff to identify, assess, and respond faster to equipment failures.

The intended audience for this SRS is twofold: 1) for the city staff managing and overseeing deploying the HITS system; and 2) for those entities (city staff, consultants and contractors) ultimately responsible for design, deployment, enhancement and/or and development of HITS-related Intelligent Transportation Systems (ITS) in Houston.

1.2 Business Context

The development of the HITS system is a result of a City of Houston (COH) initiative to actively manage the arterial network. The City of Houston Public Works and Engineering (PWE) is in responsible charge of city infrastructure. The

Traffic Operations Division (TOD), housed within PWE, oversees the transportation infrastructure of the city. TOD's stated mission is to "facilitate safe and efficient mobility on the City's streets". TOD's vision is "Integrating people, plans, and projects to deliver premier transportation management services to the City of Houston by:

- Reducing Traffic Congestion on City Streets;
- Improving Traffic Safety Measures Throughout the City;
- Linking System Improvements to Regional Goals;
- Developing New, Sustainable Resources; and
- Increasing Organizational Readiness."

The HITS project directly addresses each of these elements of the vision statement. Through real-time monitoring and control, the city can reduce congestion by using the system optimally and enabling citizens to make more informed decisions and it ties into other regional projects that use travel time monitoring and messaging to the public for enhanced mobility. In addition, through savings in delay and emissions, it makes the city's transportation system more sustainable. The collection of travel time and volume data will increase the organizations operational knowledge and allow for better planning capabilities to guide future investment.

The goals of the HITS project are to reduce travel delay, improve accessibility, and improve travel time reliability for motorists and transit vehicles on the project corridors. Through these improvements the HITS project would improve functional capacity and reduce vehicular emissions.

1.3 Scope

The scope of the project is deployment on approximately 150 arterial corridors, in 16 zones, throughout the City of Houston. The portion of the HITS project covered by this ConOps (and partially funded by the 2014 TIGER Grant) will deploy 91 Dynamic Message Signs (DMS), 138 Closed-Circuit Television (CCTV) cameras, 160 traffic count stations, 489 enhanced traffic signal detection locations. This system will leverage existing and programmed infrastructure deployments, including fiber cable/ wireless (WiMAX) communication system, 650 Bluetooth Automatic Vehicle Identification (AVI) sites, and deployment of a centralized arterial traffic management software system (ATMS).

The following statements primarily define the HITS system's scope:

- Enable traffic management staff to detect abnormal network conditions so that they may use central control to optimize operations by changing signal timing plans under various conditions;
- Provide operational visibility to enable traffic management staff to detect and respond to congestion and incidents in near-real time;
- Provide real-time traveler information to the public and partner agencies;
- Provide data for post-event analysis, TSM&O improvements, and long-term planning efforts; and

- Allow maintenance staff to identify, assess, and respond faster to equipment failures.

As part of HITS, an alarm mechanism will be developed and installed to warn operators when speeds drop below a certain threshold so that they can be monitored and/or actions taken to mitigate the congestion. In addition:

- HITS will provide a means to archive ITS/HITS data.
- HITS will include maintenance and construction operations support.
- HITS will interface with existing ITS systems.
- HITS will be designed to accommodate additional modules as necessary in the future.
- HITS will have security features to protect privacy and user identification.

1.4 User Characteristics

There are three primary classes of HITS system users: 1) city transportation management staff, 2) the traveling public, and 3) transportation system planners. How each class of user uses HITS may vary significantly, with very different priorities for each user.

The Transportation System Manager

The transportation management user consists of the team of city staff dealing with traffic and transportation that will use the HITS system to more efficiently move people and goods throughout the major arterials in the city. Through HITS, these users will have a robust set of system performance measures that will be used to make more informed decisions during daily operations and during various incidents within the arterial network. Through the proposed links to the Houston Emergency Center (City of Houston 911) the transportation management user would also have access to the dispatch status during response to incidents via a consolidated view of HPD and HFD/EMS incidents.

The Traveler

The traveler may be considered the ultimate customer and consumer in the eventual deployment of the full HITS concept. While some segment of the traveling public will want the types of information available to the transportation management user, the overall traveling public in the Houston region wants traveler information boiled down to some basic forms: travel time (preferably in real-time) and travel cost (in real-time if some type of congestion pricing is in effect). Any other information is incidental to time and cost, and is essentially provided so that the user can make the best judgment on whether to start a trip, by what mode, by what path, or whether or not to make the trip at all.

Currently, users can get information on the freeway, HOV lane, and tollway systems via the Houston TranStar website's real-time traffic map. Users can get transit route, fare, and schedule information in static form through a link from the TranStar website (to a METRO website). Arterial information available through

this project will provide alternative routing information on city streets, enabling travelers with a way to judge different arterial routes like they currently are able to do with freeway and tollway routes.

Transportation Planners

HITS will generate numerous data streams, from traffic volumes, travel times, travel speeds, and signal timing performance. This data will be useful to planners generating the needs for transportation system improvements for the City of Houston and greater Houston region.

1.5 User Needs

This section presents the high-level needs identified by city staff that can be satisfied by a HITS deployment. These user needs are presented again in the SRS document to define the functional requirements of the proposed HITS system. More details on the needs, the current capability to fulfill these needs, and the enhancements (either for in-field devices or integration) needed to realize full benefits from HITS deployment are presented in Section 7 of the *Concept of Operations* document. The seven stated needs for HITS include:

1. To provide enhanced traffic signal detection at selected intersections for normal operations and to enable additional functionality, including automated traffic counts and enhanced performance measures;
2. To provide arterial operational monitoring capability through monitoring travel times or traffic volumes;
3. To provide alarms or alerts for unusual arterial roadway operational conditions through monitoring travel times or traffic volumes;
4. To provide visual observation capability at critical points in the arterial roadway network through deployment of CCTV;
5. To automatically provide travel time information to travelers on the arterial network via roadside message signs and houstontranstar.org website;
6. To systematically collect traffic volumes at key points in the arterial roadway network; and
7. To provide an interface for the visualization and export of segment travel times and speeds, and traffic volumes from an archive.

Section 2. General System Description

2.1 System Context

The Houston region has a robust and vital ITS deployment that is constantly being refined for more efficient and effective operations, but to date this has largely been limited to freeways and tollways – access controlled facilities and state highways. The City of Houston's HITS project will bring similar capabilities to major arterials in the city.

The City of Houston has recently completed acquisition of ATMS.now, Trafficware's central software system. This acquisition was primarily based on

the need to remotely manage and control the traffic signals in the city, but also has the benefit in that it can control and monitor other ITS elements, including CCTV, DMS and detection elements. ATMS.now will be the backbone software element for HITS and will leverage other existing ITS subsystems in use now, particularly the Anonymous Wireless Address Matching (AWAM) travel time monitoring processing system for Bluetooth-base travel times and speeds.

The ITS infrastructure and devices proposed to be deployed in the HITS system includes:

- Communication Networks (Fiber Backbone, Wireless Networks, and Hardwire (Copper) Communication Lines)
- Closed Circuit Television (CCTV)
- Anonymous Wireless Address Matching (AWAM) Travel Time Monitoring
- Spot Speed and Traffic Volume Detection
- Dynamic Message Signs (DMS)
- Traffic Signals/Regional Computerized Traffic Signal System (RCTSS)
- Automated Traveler Information System (TTM to DMS)
- Regional Incident Management System (RIMS)
- HFD/HPD Incident Events Datafeed
- Houston TranStar internet and mobile internet websites

2.2 System Modes and States

Since the HITS system will consist of several different subsystems (CCTV, travel time monitoring (TTM), failure in one subsystem should not render the HITS system inoperable. When accessing HITS-generated data, the traveler should be presented with information even though all ITS data may not be available.

At a minimum, the HITS system should indicate whether a portion of the network is available for travel (open or closed), and additional traveler information provided if available. The HITS system should be setup to recognize an information gap, and process a request to investigate the problem with a maintenance call.

There may be times when the system is shut-down for maintenance or modified for operations during emergency conditions (during hurricane evacuations to preserve bandwidth, for example). Simple text messages should replace the normal web-based pages to inform the user that the service is unavailable during system maintenance.

2.3 Major System Capabilities

The major system capabilities include the input, processing and output of traffic and incident information to satisfy systems to provide information to operate and traverse the City of Houston arterial network in a more efficient and informed manner. The identified needs as outlined in Section 7 of the Concept of

Operations. The needs and anticipated capabilities provided with the HITS system are bulleted below:

1. Deploy enhanced traffic signal detection at selected intersections to supplement normal operations and enable additional functionality, including automated traffic counts and automated calculation of traffic signal performance measures;
2. Interface to the recently installed 650 reader AWAM system, giving operators and the public travel time information similar to what is currently provided on the freeway/tollway network;
3. Deploy spot speed and traffic volume sensors to provide current and historical spot speed, volume and classification data for operations and planning;
4. Create the functionality to provide operators with alarms for unusual or abnormal arterial roadway operational conditions through monitoring travel times and/or traffic volumes;
5. Deploying CCTV and providing visual observation capability at critical points in the arterial roadway network and providing snapshots to the public via the Houston TranStar website;
6. Deploying dynamic message signs to the roadside to provide automated travel time information to travelers on the arterial network and other messages as appropriate;
7. To systematically collect traffic volumes at key points in the arterial roadway network and provide information for planners to use in their efforts to develop the most appropriate projects for our region; and
8. To provide an interface for the visualization and export of segment travel times and speeds, and traffic volumes from an archive.

2.4 Assumptions & Dependencies

A significant assumption for deployment of the HITS system is that the TranStar partner agencies remain together under a common IS infrastructure at TranStar. There is no reason to envision that this existing relationship will change, but if any of the transportation agencies physically move from TranStar the structure and requirements of the HITS system would have to be reassessed with regard to TranStar IS requirements.

2.5 Operational Scenarios

Descriptions of Operational Scenarios envisioned for the HITS system may be found in Section 11 of the *Concept of Operations*.

Section 3. System Capabilities, Conditions, and Constraints

3.1 Business Requirements

Business Requirements describe what functions or services must be delivered or accomplished to provide value to the agency, to partner agencies, and to the traveling public. With respect to HITS, the business requirements can essentially be specified by providing the information and functionality satisfying the primary goals of the HITS system:

1. Deploy enhanced traffic signal detection at selected intersections;
2. Deploy spot speed and traffic volume sensors;
3. Provide operators with alarms for unusual or abnormal arterial roadway operational conditions;
4. Deploying CCTV and providing visual observation capability at critical points in the arterial roadway network and providing CCTV snapshots to the public;
5. Provide automated travel time and incident information to travelers on the arterial network via dynamic message signs; and
6. Collect traffic volumes and arterial travel times on the arterial roadway network for planning efforts.

To meet these goals, the city must embrace an operations (and maintenance) doctrine and dedicate the personnel and materials needed to optimize return on the ITS investment. As the city grows, and the arterial network carries more traffic, operating efficiently and giving motorists information on network status will become more critical. Managing delay and utilizing spare capacity within the city's arterial network must be done by encouraging temporal, route and/or mode shifts.

HITS should result in a reduction in overall total trip- and person-travel time through the network, improve travel time predictability, increase transit ridership, encouraging vanpooling and carpooling, telecommuting, and improve commercial vehicle operations through the network. HITS should also enable a more systematic approach during incidents and special events occurring within the corridor (or that have regional impacts).

3.2 Functional and Non-Functional Requirements

This subsection defines the fundamental actions that must take place within the HITS system. It identifies high-level functions that the HITS system must perform and includes discussion on the functions needed from other systems through various interfaces.

Requirement ID	Requirement Description	User Need	Source	Priority	Agency/ Responsibility	Identify one of the following: (1)Meet in Full (2)Meet in Part (additional development needed) (3)Does not meet (to be developed)	Briefly explain how requirement is met or will be met.
C1 HITS Design Constraints							
C1.01	The HITS shall use existing TranStar system/subsystem interfaces if they exist	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.02	The HITS shall comply with National ITS Standards	1,2,3,4,5,6,7	Con Ops Section 7	Medium	HITS System		
C1.03	The HITS shall comply with the Regional ITS Architecture	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.04	The HITS shall access existing City of Houston communication protocols to communicate to field devices	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.04.01	The HITS shall use City of Houston WiMAX communications protocols to communicate to field devices	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.04.02	The HITS shall use City of Houston Ethernet communications protocols to communicate to field devices	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.05	The HITS shall comply with pertinent legal restrictions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.05.01	The HITS shall comply with the TranStar Master Operating Agreement	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.06	The HITS shall be compliant with operational agreement constraints	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.06.01	The HITS shall comply with applicable operating agreements regarding interagency control of transportation management systems	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.06.02	The HITS shall comply with existing operating agreements regarding use of traffic and transit information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.07	The HITS shall be compliant with existing TranStar IS hardware supplier constraints	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.08	The HITS shall be compliant with existing TranStar IS operating system constraints	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.09	The HITS shall be compliant with the TranStar relational database constraints	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.10	The HITS shall be compliant with TranStar internet services constraints	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.11	The HITS shall be compliant with TranStar IS programming language preferences	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.12	The HITS shall be compliant with TranStar IS programming language constraints	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
C1.13	The HITS shall be designed to comply with TranStar Center environmental conditions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1 HITS Hardware Requirements							
H1.01	HITS shall require a HITS server(s) (including processor, storage, backup/restore hardware) that complies with TranStar IS standards	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.02	HITS shall require seven (7) dedicated HITS workstations (including processor, storage, and backup/restore hardware) that complies with TranStar IS standards	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.03	The HITS shall use existing TranStar printing systems	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.04	The HITS shall use the existing video snapshot capture subsystem	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.05	The HITS shall use existing TranStar internet connections	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

H1.06	The HITS shall have access to the existing TranStar relational database(s) as necessary	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.07	The HITS shall use existing TranStar Center to Center Communication Systems	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.08	The HITS shall use City of Houston Center to Field Communication Systems	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.09	The HITS shall use the existing TranStar Firewall	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.10	The HITS shall use existing TranStar Router as necessary	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
H1.11	The City of Houston shall retain necessary spare equipment for HITS	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
H1.12	The City of Houston shall provide maintenance to HITS	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
D1	HITS Database & Information Management						
D1.01	The HITS shall provide database storage gathered from external systems for current information about the transportation network	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.01.01	The HITS shall store current CCTV operational status	4	Con Ops Section 7	High	HITS System		
D1.01.02	The HITS shall store current CCTV snapshots	4	Con Ops Section 7	High	HITS System		
D1.01.03	The HITS shall store current DMS operational information	5	Con Ops Section 7	High	HITS System		
D1.01.03.01	The HITS shall store current DMS operational status	5	Con Ops Section 7	High	HITS System		
D1.01.03.02	The HITS shall store current DMS messages	5	Con Ops Section 7	High	HITS System		
D1.01.03.02.01	The HITS shall store current single phase DMS messages	5	Con Ops Section 7	High	HITS System		
D1.01.03.02.02	The HITS shall store current multi-phase DMS messages	5	Con Ops Section 7	High	HITS System		
D1.01.04	The HITS shall store current signal system information from the signal management system	1	Con Ops Section 7	High	HITS System		
D1.01.04.01	The HITS shall store current signal state (operational status: normal, flash, etc.)	1	Con Ops Section 7	High	HITS System		
D1.01.04.02	The HITS shall store current traffic volume information gathered by the traffic signal	2	Con Ops Section 7	High	HITS System		
D1.01.05	The HITS shall store current communication link status to field devices	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.01.06	The HITS shall store current City of Houston generated incident information	5	Con Ops Section 7	High	HITS System		
D1.01.06.01	The HITS shall store current HPD incident information content scraped from the HPD/HFD incident webpage	5	Con Ops Section 7	High	HITS System		
D1.01.06.02	The HITS shall store current HFD incident information content scraped from the HPD/HFD incident webpage	5	Con Ops Section 7	High	HITS System		
D1.01.07	The HITS shall store current manually entered incident information	5	Con Ops Section 7	High	HITS System		
D1.01.08	The HITS shall store current traffic volume information gathered by mid-block detection sensors	2	Con Ops Section 7	High	HITS System		
D1.02	The HITS shall provide database storage for historical information pertaining to the transportation network	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.02.01	The HITS shall provide database storage for historical DMS information	5,7	Con Ops Section 7	High	HITS System		
D1.02.01.01	The HITS shall provide database storage for historical DMS messages	5,7	Con Ops Section 7	High	HITS System		
D1.02.01.02	The HITS shall provide database storage for historical DMS operational status	5,7	Con Ops Section 7	High	HITS System		
D1.02.02	The HITS shall provide database storage for historical travel time DMS messages	5,7	Con Ops Section 7	High	HITS System		

D1.02.03	The HITS shall provide database storage for historical CCTV operational status	4	Con Ops Section 7	High	HITS System		
D1.02.04	The HITS shall provide database storage for historical link-based travel time information	5,7	Con Ops Section 7	High	HITS System		
D1.02.05	The HITS shall provide database storage for historical intersection information	1,5,7	Con Ops Section 7	High	HITS System		
D1.02.05.01	The HITS shall provide database storage for historical intersection volumes	1,5,7	Con Ops Section 7	High	HITS System		
D1.02.05.01.01	The HITS shall provide database storage for historical intersection volumes by turning movement	1,5,7	Con Ops Section 7	High	HITS System		
D1.02.05.01.02	The HITS shall provide database storage for historical intersection volumes in total	1,5,7	Con Ops Section 7	High	HITS System		
D1.02.05.02	The HITS shall provide database storage for historical intersection status (normal, flash, etc.)	5,7	Con Ops Section 7	High	HITS System		
D1.02.05.03	The HITS shall provide database storage for historical intersection equipment operational status	5,7	Con Ops Section 7	High	HITS System		
D1.02.06	The HITS shall provide database storage for historical communication link status	5,7	Con Ops Section 7	High	HITS System		
D1.02.07	The HITS shall provide database storage for historical traffic volume information gathered by mid-block detectors	5,7	Con Ops Section 7	High	HITS System		
D1.03	The HITS shall provide database storage for device metadata	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.03.01	The HITS shall provide database storage for ITS equipment ID	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.03.02	The HITS shall provide database storage for ITS equipment type of device	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.03.03	The HITS shall provide database storage for ITS equipment location	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.03.04	The HITS shall provide database storage for ITS equipment IP address	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.03.05	The HITS shall provide database storage for ITS device symbols	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.04	The HITS shall use Microsoft Bing Maps for transportation network geometry/base maps	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.05	The HITS shall provide historical data reduction processing capability	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.06	The HITS shall provide for the ability to store HITS data off-line in archives	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.06.01	The HITS shall provide ability to archive data to offline storage	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.06.02	The HITS shall provide the ability to verify an archive then delete data	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.06.03	The HITS shall provide the ability to restore data from offline storage	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.07	The HITS shall provide database storage for system configuration information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.07.01	The HITS shall provide database storage for logging system configuration information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.07.02	The HITS shall provide database storage for logging system configuration change information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.08	The HITS shall provide database storage for user account information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.08.01	The HITS shall provide database storage for public agency account information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.08.02	The HITS shall provide database storage for operator user account information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

D1.09	The HITS shall retain archived information for at least 20 years	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.10	The HITS shall retain historical information for at least 730 days (2 years)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.11	The HITS shall retain information from at least 15,000 alarms in most recent chronological order	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.12	The HITS shall retain information from authentication login/logoff for at least 10,000 records	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13	The HITS shall provide a reporting subsystem	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.01	The HITS reporting subsystem shall provide preconfigured standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.01.01	The HITS reporting subsystem shall provide the ability to request standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.01.02	The HITS reporting subsystem shall provide the ability to save standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.01.03	The HITS reporting subsystem shall provide the ability to view standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.02	The HITS reporting subsystem shall provide scheduled standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.02.01	The HITS reporting subsystem shall provide the ability to produce a scheduled report	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.02.02	The HITS reporting subsystem shall provide the ability to save a scheduled report	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.02.03	The HITS reporting subsystem shall provide the ability to view a scheduled report	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.03	The HITS reporting subsystem shall provide standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.03.01	The HITS reporting subsystem shall provide the ability to request standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.03.02	The HITS reporting subsystem shall provide the ability to save standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.03.03	The HITS reporting subsystem shall provide the ability to view standard reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.04	The HITS reporting subsystem shall provide new user defined custom reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.04.01	The HITS reporting subsystem shall provide the ability to request new user defined custom reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.04.02	The HITS reporting subsystem shall provide the ability to save new user defined custom reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.04.03	The HITS reporting subsystem shall provide the ability to view new user defined custom reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.05	The HITS reporting subsystem shall provide a user to save a custom report as a template	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.05.01	The HITS reporting subsystem shall provide the ability to request a template-based custom reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.05.02	The HITS reporting subsystem shall provide the ability to save a template-based custom report	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
D1.13.05.03	The HITS reporting subsystem shall provide the ability to view a template-based custom report	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

D1.14	The HITS shall use City of Houston Public safety video system for CCTV integration and access	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F HITS Functional Requirements							
F1	The HITS shall acquire information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F1.01	The HITS shall acquire travel time information	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01	The HITS shall acquire current processed information from the TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01	The HITS shall acquire current TTM processed information from the TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.01	The HITS shall acquire the origin ID in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.02	The HITS shall acquire the origin roadway in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.03	The HITS shall acquire the origin direction in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.04	The HITS shall acquire the origin facility type in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.05	The HITS shall acquire the origin cross street in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.06	The HITS shall acquire the destination ID in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.07	The HITS shall acquire the destination roadway in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.08	The HITS shall acquire the destination direction in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.09	The HITS shall acquire the destination facility type in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.10	The HITS shall acquire the destination cross street in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.11	The HITS shall acquire the segment length in the TTM XML data stream	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.12	The HITS shall acquire the rolling 30 second average TTM speed, by segment, in miles per hour, for all TTM segments in the COH TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.13	The HITS shall acquire the rolling 30 second average TTM travel time, by segment, in miles per hour, for all TTM segments in the COH TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.14	The HITS shall acquire the prior year's average TTM speed, by 15 minute increment, by segment, in miles per hour, for all TTM segments in the TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.15	The HITS shall acquire the prior year's average TTM travel time, by 15 minute increment, by segment, in miles per hour, for all TTM segments in the COH TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.01.16	The HITS shall acquire the TTM update timestamp, by segment, upon each update	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.02	The HITS shall acquire historical TTM processed information from the TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.02.01	The HITS shall acquire the origin ID in the TTM historical database	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.02.02	The HITS shall acquire the destination ID in the TTM historical database	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.02.03	The HITS shall acquire the timestamp beginning of the 15 minute time period that the average summarizes in the TTM historical database	2,3,5,7	Con Ops Section 7	High	HITS System		

F1.01.01.02.04	The HITS shall acquire the average speed in MPH for the 15 minute time period, by segment in the TTM historical database	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.02.05	The HITS shall acquire the incident alarm threshold speed in MPH for the 15 minute time period, by segment in the TTM historical database	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.02.06	The HITS shall acquire the average travel time in minutes:seconds for the 15 minute time period, by segment in the TTM historical database	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.01.01.02.07	The HITS shall acquire the TTM database code representing the day of the week the average consists of (1-7, Sunday-Saturday) in the TTM historical database	2,3,5,7	Con Ops Section 7	High	HITS System		
F1.02	The HITS shall acquire processed information from the Traffic Detection Subsystem	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.01	The HITS shall acquire "real time" processed information from the Traffic Detection Subsystem	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.01.01	The HITS shall acquire the unique sensor ID from the Traffic Detection Subsystem data stream	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.01.02	The HITS shall acquire the timestamp, by sensor, in the Traffic Detection Subsystem DataStream	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.01.03	The HITS shall acquire the sensor location ID, by sensor, in the Traffic Detection Subsystem processed data data stream	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.01.04	The HITS shall acquire the number of vehicles, by lane, by user configurable time period, by sensor, in the Traffic Detection Subsystem processed data stream	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.01.05	The HITS shall acquire the average speed of vehicles, by lane, by user configurable time period, by sensor, in the Traffic Detection Subsystem processed data stream	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.01.06	The HITS shall acquire the average lane occupancy, by lane, by user configurable time period, by sensor, in the Traffic Detection Subsystem processed data stream	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.02	The HITS shall acquire historical processed traffic data sensor information from the Traffic Detection Subsystem	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.02.01	The HITS shall acquire the sensor ID in the traffic detection subsystem historical database	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.02.02	The HITS shall acquire the historical timestamp, by sensor, in the Traffic Detection Subsystem database	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.02.03	The HITS shall acquire the number of vehicles, by lane, by user configurable time period, by sensor, in the historical Traffic Detection Subsystem database	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.02.04	The HITS shall acquire the average historical processed speed of vehicles, by lane, by user configurable time period, by sensor, in the Traffic Detection Subsystem database	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.02.02.05	The HITS shall acquire the average historical lane occupancy, by lane, by user configurable time period, by sensor, in the Traffic Detection Subsystem database	1,2,3,6,7	Con Ops Section 7	High	HITS System		
F1.03	The HITS shall acquire processed information from the CCTV Subsystem	4	Con Ops Section 7	High	HITS System		
F1.03.01	The HITS shall acquire the camera ID from each camera within the HITS corridor from the CCTV subsystem	4	Con Ops Section 7	High	COH Cameras		

F1.03.02	The HITS shall acquire the camera description from each camera within the HITS corridor from the CCTV subsystem	4	Con Ops Section 7	High	COH Cameras		
F1.03.03	The HITS shall acquire the camera name from each camera within the HITS corridor from the CCTV subsystem	4	Con Ops Section 7	High	COH Cameras		
F1.03.04	The HITS shall acquire the blackout status indicator from each camera within the HITS corridor from the CCTV subsystem	4	Con Ops Section 7	High	COH Cameras		
F1.03.05	The HITS shall acquire the position (lat/long) from each camera within the HITS corridor from the CCTV subsystem	4	Con Ops Section 7	High	COH Cameras		
F1.03.06	The HITS shall acquire the most recent snapshot from each camera within the HITS corridor from the CCTV subsystem	4	Con Ops Section 7	High	COH Cameras		
F1.03.07	The HITS shall acquire the CCTV display order from each camera within the HITS corridor from the CCTV subsystem	4	Con Ops Section 7	High	COH Cameras		
F1.04	The HITS shall acquire processed information from the DMS Subsystem	5,7	Con Ops Section 7	High	HITS System		
F1.04.01	The HITS shall acquire the DMS ID from each DMS from the DMS subsystem	5,7	Con Ops Section 7	High	COH Cameras		
F1.04.02	The HITS shall acquire the DMS description from each DMS from the DMS subsystem	5,7	Con Ops Section 7	High	COH Cameras		
F1.04.03	The HITS shall acquire the DMS name from each DMS from the DMS subsystem	5,7	Con Ops Section 7	High	COH Cameras		
F1.04.05	The HITS shall acquire the position (lat/long) from each DMS from the DMS subsystem	5,7	Con Ops Section 7	High	COH Cameras		
F1.04.06	The HITS shall acquire the current message from each DMS from the DMS subsystem	5,7	Con Ops Section 7	High	COH Cameras		
F1.05	The HITS shall acquire alert information	3	Con Ops Section 7	High	HITS System		
F1.05.01	The HITS shall acquire information from RIMS databases	3	Con Ops Section 7	High	HITS System		
F1.05.02	The HITS shall acquire information from TxDOT/TranStar construction activity databases	3	Con Ops Section 7	High	HITS System		
F2	The HITS shall process data	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.01	The HITS shall time sync with TranStar IS designated time source(s)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.02	The HITS shall process user input	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.02.01	The HITS shall ensure that user input data is valid	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.02.02	The HITS shall ensure that user input data is internal/external system parameters	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.03	The HITS shall store data/information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.03.01	The HITS shall store information in databases with periodic updates specified in the performance requirements	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.03.02	The HITS shall store data in a historical database	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.03.02.01	The HITS shall store all input data in a historical database	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.03.02.02	The HITS shall store all processed data in a historical database	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.03.02.03	The HITS shall store all output data in a historical database	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.04	The HITS shall process TTM Subsystem-processed link travel times	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.05	The HITS shall automatically detect abnormal conditions by comparing current to historic conditions	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.05.01	The HITS shall use the existing TTM Subsystem-generated alarms for incidents	2,3,5,7	Con Ops Section 7	High	HITS System		

F2.05.02	The HITS shall determine if current speeds are below user-settable thresholds	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.05.02.01	The HITS shall determine if current segment speed drops below a user-settable speed threshold, by time of day in 15-minute intervals, by link, by direction	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.05.02.02	The HITS shall determine if segment speed drops below a user-settable percentage of a distribution of historical travel speeds in 15-minute intervals, by link, by direction	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.05.03	The HITS shall process traffic volume data to determine probable incidents	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06	The HITS shall process enhanced detection (midblock) data	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.01	The HITS shall process enhanced detection (midblock) volume data	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.01.01	The HITS shall automatically detect abnormal conditions by comparing current volume to historic volume conditions	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.01.02	The HITS shall determine if current volumes are below user-settable volume thresholds	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.01.02.01	The HITS shall determine if current volume drops below a user-settable volume threshold, by time of day in 15-minute intervals, by link, by direction	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.01.02.02	The HITS shall determine if segment volume drops below a user-settable percentage of a distribution of historical volumes in 15-minute intervals, by link, by direction	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.02	The HITS shall process enhanced detection (midblock) speed data	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.02.01	The HITS shall automatically detect abnormal conditions by comparing current speed to historic speed conditions	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.02.02	The HITS shall determine if current speeds, by lane, by time of day, are below user-settable speed thresholds	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.02.02.01	The HITS shall determine if current speed drops below a user-settable speed threshold, by time of day in 15-minute intervals, by link, by direction	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.02.02.02	The HITS shall determine if segment speed drops below a user-settable percentage of a distribution of historical speed in 15-minute intervals, by link, by direction	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.03	The HITS shall process enhanced detection (midblock) vehicle classification data	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.06.04	The HITS shall process traffic volume data to determine probable incidents	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.07	The HITS shall include information processing to manage incidents/events (planned/unplanned)	3,5,7	Con Ops Section 7	High	HITS System		
F2.07.01	The HITS shall include a module used by operators to confirm system generated automatic incident notifications	3,5,7	Con Ops Section 7	High	HITS System		
F2.07.02	The HITS shall include a module used by operators to dismiss system generated automatic incident notifications	3,5,7	Con Ops Section 7	High	HITS System		
F2.07.03	The HITS shall have the ability to assist operators in implementing an incident response	3,5,7	Con Ops Section 7	High	HITS System		
F2.07.03.01	The HITS shall have the ability to interface with the DMS Subsystem to send DMS messages automatically	5	Con Ops Section 7	High	HITS System		

F2.07.03.02	The HITS shall have the ability to interface with the DMS Subsystem to send DMS messages with operator approval	5	Con Ops Section 7	High	HITS System		
F2.07.03.03	The HITS shall have the ability to send traveler information messages automatically	5	Con Ops Section 7	High	HITS System		
F2.07.03.04	The HITS shall have the ability to send traveler information messages with incremental approval by operators	5	Con Ops Section 7	High	HITS System		
F2.07.04	The HITS shall process traveler information intended to be published to the Houston TranStar website	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.05	The HITS shall have the ability to send personnel notifications of incidents/events/alarms	3	Con Ops Section 7	High	HITS System		
F2.07.06	The HITS shall have the ability to edit DMS messages through a message switch to the DMS Subsystem	5	Con Ops Section 7	High	HITS System		
F2.07.07	The HITS shall have an allowable word dictionary which is checked against before any DMS message is posted to field devices	5	Con Ops Section 7	High	HITS System		
F2.07.08	The HITS shall have the ability to cancel DMS messages through a message switch to the DMS Subsystem	5	Con Ops Section 7	High	HITS System		
F2.07.09	The HITS shall have the ability to clear an Incident/event record and return to normal system operations automatically	5	Con Ops Section 7	High	HITS System		
F2.07.09.01	The HITS shall have the ability to terminate DMS messages via message switches to those subsystems	5	Con Ops Section 7	High	HITS System		
F2.07.09.02	The HITS shall process and store clearance Information historical databases	5	Con Ops Section 7	High	HITS System		
F2.07.09.03	The HITS shall interface with the DMS Subsystem to return DMS assets to normal use	5	Con Ops Section 7	High	HITS System		
F2.07.09.04	The HITS shall have the ability to notify traveler information messages of normal conditions (incident clear, etc.)	5	Con Ops Section 7	High	HITS System		
F2.07.10	The HITS shall have the ability to clear an Incident/event record and return to normal system operations by incremental operator action	5	Con Ops Section 7	High	HITS System		
F2.07.10.01	The HITS shall have the ability to terminate DMS messages via message switches to those subsystems	5	Con Ops Section 7	High	HITS System		
F2.07.10.02	The HITS shall process and store clearance Information historical databases	5	Con Ops Section 7	High	HITS System		
F2.07.10.03	The HITS shall interface with the DMS Subsystem and return DMS assets to normal use	5	Con Ops Section 7	High	HITS System		
F2.07.10.04	The HITS shall have the ability to notify traveler information messages of normal conditions (incident clear, etc.)	5	Con Ops Section 7	High	HITS System		
F2.07.11	The HITS shall process alert information from external subsystems	3	Con Ops Section 7	High	HITS System		
F2.07.11.01	The HITS shall process alert information from the TTM Subsystem	2,3,5,7	Con Ops Section 7	High	HITS System		
F2.07.11.02	The HITS shall process alert information from the Traffic Signal Control Subsystem	1	Con Ops Section 7	High	HITS System		
F2.07.12	The HITS shall process video to snapshot capture files through interface with the CCTV subsystem	4	Con Ops Section 7	High	HITS System		
F2.07.13	The HITS shall calculate and/or determine corridor performance measures	1,2,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.14.01	The HITS shall determine current arterial level of service	1,2,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.14.02	The HITS shall determine current arterial volumes	1,2,5,6,7	Con Ops Section 7	High	HITS System		

F2.07.14.03	The HITS shall determine corridor travel time measures	1,2,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.14.04	The HITS shall determine corridor ITS equipment availability measures (piece reliability, pct uptime)	1,2,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.14.05	The HITS shall determine data quality measures (percent incremental data available, etc.)	1,2,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.15	The HITS shall monitor communication links status	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.15.01	The HITS shall log communication failures and resumptions, by device, time stamped	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.15.02	The HITS shall alert operators to communication failures and resumptions, by device	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.16	The HITS shall process equipment outage statistics	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.16.01	The HITS shall process equipment outage statistics in predetermined reports (real-time, daily, weekly, monthly, etc.) sent automatically to designated recipients. By device	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F2.07.16.02	The HITS shall process equipment outage statistics on an as-needed basis per operator request, by device	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3	The HITS shall publish information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.01	The HITS shall send control commands to subsystems	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.01.01	The HITS shall send DMS control command(s) to the DMS Subsystem	5	Con Ops Section 7	High	HITS System		
F3.02	The HITS shall present traffic/HITS information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.01	The HITS shall present information via map displays	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.02	The HITS shall present information via tabular displays, with clickable links for available details	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.03	The HITS shall present information via electronic reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.04	The HITS shall present information through printed reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.05	The HITS shall present information via graphics and charting	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.06	The HITS shall display corridor video on HITS operator displays	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.07	The HITS shall generate audible alarms	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.07.01	The HITS shall allow the user to manually silence audible alarms	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.07.02	The HITS shall allow the user to set a duration, in seconds, to automatically silence audible alarms	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.08	The HITS shall publish information via text messaging (internal COH staff only)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.09	The HITS shall publish information via Email (internal COH staff only)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.10	The HITS shall publish information via Houston TranStar website	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.11	The HITS shall have the ability to publish information to travel web sites, including third party sites	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.12	The HITS shall have the ability to publish information via Information Service Providers (third party providers and media)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.02.13	The HITS shall have the ability to publish information in database log files	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.03	The HITS shall have the ability to print transportation/HITS information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.03.01	The HITS shall have the ability to print outage reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F3.03.02	The HITS shall have the ability to publish calculated travel time information to DMS locations via the DMS Subsystem-TTM Subsystem update engine	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

F3.03.03	The HITS shall have the ability to print any report generated by the HITS system	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4	The HITS shall provide advanced traveler information services (ATIS)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.01	The HITS shall provide information through the TranStar website	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.01.01	The HITS webpage shall allow users to view map data	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.01.01.01	The HITS webpage shall allow users to view traffic speeds, by facility type (freeway/toll way, arterial, HOV, or other)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.01.01.02	The HITS webpage shall allow users to view incident alerts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.01.02	The HITS webpage shall allow users to view CCTV snapshots	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.02	The HITS shall provide integrate mobile website information through the TranStar website	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.02.01	The HITS mobile webpage shall allow users to view simplified map data (black background map)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.02.02	The HITS mobile webpage shall allow users to view, graphically, speeds, incidents and alarms on separate pages	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.02.03	The HITS mobile webpage shall allow users to view camera views on the mobile webpage	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
F4.03	The HITS shall allow approved users access to real-time video feeds using and integrated City of Houston Public Safety video system	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1	HITS Interface Requirements						
IF1.01	The HITS shall provide a user interface that is fully customizable	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.01	The HITS shall provide the capability to manage a HITS user account	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.01.01	The HITS shall provide the capability to create a HITS user account	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.01.02	The HITS shall provide the capability to modify a HITS user account	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.01.03	The HITS shall provide the capability to delete a HITS user account	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.02	The HITS shall provide the capability for users to log in and out of the HITS	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.03	The HITS interface shall provide the capability for users to subscribe to email message services	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.03.01	The HITS interface shall provide the capability for users to subscribe to email message services for travel times	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.03.02	The HITS interface shall provide the capability for users to subscribe to email message services for incidents	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.04	The HITS shall display a map showing transportation network information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.05	The HITS shall display tabular/text transportation network information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.06	The HITS interface shall display CCTV video snapshots	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.01.07	The HITS shall display alert information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.02	The HITS shall provide an operator interface for arterial transportation management	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.02.01	Provide an interface for HITS to receive information	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.02.01.01	Provide an interface for HITS to receive traffic management system information	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.02.01.02	Provide an interface for HITS to receive traffic signal system information	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.02.01.03	Provide an interface for HITS to receive street cut permit event information	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		

IF1.02.01.04	Provide an interface for HITS to receive RIMS event information	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.02.01.05	Provide an interface for HITS to receive HFD/HPD combined incident information (web scrape)	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.02.02	Provide an interface for HITS to send control message sets to the DMS subsystem	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03	The HITS shall provide an HITS administrator interface	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.01	The HITS shall provide a capability to log in and out of the HITS	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.02	The HITS shall provide a capability to manage Operator/Administrator accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.02.01	The HITS shall provide a capability to create Operator/Administrator accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.02.02	The HITS shall provide a capability to modify Operator/Administrator accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.02.03	The HITS shall provide a capability to delete Operator/Administrator accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.03	The HITS shall provide a capability to manage External user accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.03.01	The HITS shall provide a capability to add External user accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.03.02	The HITS shall provide a capability to modify External user accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.03.03	The HITS shall provide a capability to delete External user accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.04	The HITS shall provide an administrator capability to modify HITS configuration parameters	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.05	The HITS shall provide an administrator capability to monitor HITS performance	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.06	The HITS shall provide an administrator capability to manage response plan information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.06.01	The HITS shall provide an administrator capability to add response plan information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.06.02	The HITS shall provide an administrator capability to modify response plan information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.06.03	The HITS shall provide an administrator capability to delete response plan information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.07	The HITS shall provide an administrator capability to configure HITS information acquisition	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.03.08	The HITS shall provide an administrator capability to configure HITS information publication	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.04	The HITS shall provide operator interfaces to roadside ITS equipment subsystems by launching browser-based windows	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.04.01	Provide operator interface for HITS to access the DMS subsystem to control DMS equipment	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.04.02	Provide operator interface for HITS to monitor DMS equipment	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.04.03	Provide operator interface for HITS to monitor TTM equipment	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.04.04	Provide operator interface for HITS to monitor vehicle detection equipment	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.04.05	Provide operator interface for HITS to receive CCTV video	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.04.06	Provide operator interface for HITS to access the CCTV subsystem to control CCTV cameras	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		

IF1.04.07	Provide operator interface for HITS to monitor operational status of CCTV equipment (normal, communications fail, camera fail, etc.)	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.04.08	Provide operator interface from HITS to monitor performance characteristics (uptime) of ITS devices through individual subsystems	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.05	The HITS shall provide operator interfaces to HITS components	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.05.01	The HITS shall provide operator capability to log on and off the HITS	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.02	The HITS shall provide operator capability to view information about current transportation network conditions and status	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.03	The HITS shall provide a display listing non-functional ITS field and/or communications components	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.04	The HITS shall provide operator capability to view RIMS incident data via turning on a map layer	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.05	The HITS shall provide operator capability to create a series of response options to a given incident scenario to control DMS	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.05.01	The HITS shall provide operator capability to request incident and/or event recommended actions (e.g., DMS signs to post)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.05.02	The HITS shall provide operator capability to view recommended response actions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.05.03	The HITS shall provide operator capability to select response actions to be implemented	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.05.04	The HITS shall provide operator capability to implement automated response actions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.05.05	The HITS shall provide operator capability to implement manually selected response actions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.06	The HITS shall provide operator capability to view invoked response plan actions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.06.01	Provide operator capability to view invoked response plan actions executed	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.06.02	Provide operator capability to view invoked response plan actions not executed (and for what reason)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.07	The HITS shall provide controls for interface to the traffic signal subsystems to control signal timing plans	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.05.08	The HITS shall present corridor network conditions on map displays	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.01	The HITS shall present planned events on the map display as an event icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.01.01	The HITS shall present active planned events on the map display	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.01.02	The HITS shall present inactive (future/recurring) planned events on the map display	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.01.03	The HITS shall provide operator controls to enter planned events	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.02	The HITS shall present incidents on the map display as an event icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.02.01	The HITS shall present unverified (system detected) incidents on the map display as an event icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.02.02	The HITS shall present verified incidents on the map display as an event icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.02.03	The HITS shall present cleared incidents on the map display as an event icon for no more than 5 minutes	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

IF1.05.08.03	The HITS shall display current link traffic information when operator clicks on a roadway link	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.03.01	The HITS shall display current link average current travel speed via the TTM subsystem when operator clicks on a roadway link	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.03.02	The HITS shall display current link average current travel time via the TTM subsystem when operator clicks on a roadway link	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.03.03	The HITS shall display current link average historic travel speed via the TTM subsystem when operator clicks on a roadway link (for user-defined average speed for current 15-minute interval by time of day)	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.03.04	The HITS shall display current link average historic travel time via the TTM subsystem when operator clicks on a roadway link (for user-defined average speed for current 15-minute interval by time of day)	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.04	The HITS shall show link/signal status using green and uncongested, yellow as moderately congested, and red as congested	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.04.01	The HITS shall show arterial link status using green and uncongested, yellow as moderately congested, and red as congested	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.04.01.01	The HITS shall allow the user to configure speed thresholds to show arterial link status using green and uncongested, yellow as moderately congested, and red as congested	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.04.02	The HITS shall show traffic signal status using green and uncongested, yellow as moderately congested, and red as congested	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.04.02.01	The HITS shall allow the user to define traffic signal status using green and operational, yellow as may be operational, and red as inoperational or unknown	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.05	The HITS shall allow users to modify travel time segment speed indicators for green and uncongested, yellow as moderately congested, and red as congested, by time of day	2,3,7	Con Ops Section 7	High	HITS System		
IF1.05.08.06	The HITS shall present roadside equipment status information as color-coded icons	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
IF1.05.08.07	The HITS shall allow the operator to select a measure of effectiveness to display on the link/intersection status screen	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.07.01	The HITS shall allow the operator to select a measure of effectiveness to display on the link/intersection status screen: speed	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.07.02	The HITS shall allow the operator to select a measure of effectiveness to display on the link/intersection status screen: volume	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08	The HITS shall display current system information when operator clicks on an icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.01	The HITS shall display current signal system information when operator clicks on signal icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.02	The HITS shall display current maintenance information from GIMS when operator clicks on a roadway maintenance icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.03	The HITS shall display current street cut permit information from GIMS when operator clicks on a roadway lane closure icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.04	The HITS shall display current DMS message when operator clicks on DMS icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.05	The HITS shall display current incident information when operator clicks on incident icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

IF1.05.08.08.06	The HITS shall display current event information when operator clicks on event icon	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.07	The HITS shall save the current display state	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.07.01	The HITS shall allow a user to save the current display state	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.08.07.02	The HITS shall allow a user to view the previous display state upon login	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.09	The HITS shall display current information as shaded overlays on the map	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.09.01	The HITS shall display weather radar as a shaded overlay on the map	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.09.02	The HITS shall provide operator controls to select the active data/information layers to be displayed on the map	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.08.09.03	The HITS shall provide operator controls to turn on/off layers including roadway types, railways, transit routes, zip codes, jurisdictional boundaries, water features, and other layers	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.09	The HITS shall provide corridor transportation network conditions in tabular display format	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.10	The HITS shall provide operator controls to select subsets of information to be displayed	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.11	The HITS shall provide a reporting system for operators	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.01	The HITS shall provide operators on-screen reports display	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.02	The HITS shall provide operators with graphic charts of selected data	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.03	The HITS shall provide the ability for operators to view time series graphs of operator selected data	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.04	The HITS shall provide audible alarms for events	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.04.01	The HITS shall provide the ability to silence alarms for predetermine time periods (1, 5, 10 minutes, etc.)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.04.02	The HITS shall provide the ability to choose what alarms should be audible	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.05	The HITS shall provide operators an on-screen report of log of events which generate alarms	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.06	The HITS shall provide operators with a report of system actions and events	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.05.12.07	The HITS shall provide operators with the ability to print reports	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.06	The HITS shall provide an interface to the Houston TranStar website server(s)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.06.01	HITS shall have an interface for the system to send information to TranStar website	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.06.02	HITS shall provide an interface for the system to send information to subscribers via email	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.07	The HITS shall provide an interface to receive regional alerts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.07.01	The HITS shall provide an interface to receive alerts from first responders	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.07.01.01	The HITS shall provide an interface to receive alerts from local police	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.07.01.02	The HITS shall provide an interface to receive alerts from local fire/EMS/hazmat services	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
IF1.07.02	The HITS shall provide an interface for the system to publish alerts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

IF1.08	The HITS shall provide capability to be fully compatible with existing City of Houston Public Safety video system	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1 HITS System Performance Requirements							
P1.01	The HITS shall perform information acquisition using minimum intervals	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.01.01	The HITS shall acquire traffic information at least once every 60 seconds	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
P1.01.02	The HITS shall publish automated travel time messages to DMS every 8-10 minutes	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
P1.01.03	The HITS shall acquire planned event information at least once every 10 minutes	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
P1.01.04	The HITS shall acquire 911/CAD information at least once every 2 minutes	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
P1.02	The HITS shall track information processing performance	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.02.01	The HITS shall process traffic information and determine possible incident locations at same frequency as traffic data is acquired	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.02.02	The HITS shall process and store transportation network information within 2 seconds	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.02.03	The HITS shall process traffic information and calculate travel times at same frequency as traffic data is acquired	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.02.04	The HITS shall process and store any HITS alert information within 2 seconds	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.02.05	The HITS shall process and store any HITS Subsystem alert information within 2 seconds	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.02.06	The HITS shall process user authentication and modification within 2 seconds	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03	The HITS shall track HITS data/information dissemination performance	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.01	The HITS shall display WWW information to external users within 5 seconds of request	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.02	The HITS shall display HITS operator interface screens within 2 seconds of request	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.03	The HITS shall complete the display of all requested information on HITS operator screens within 20 seconds of request	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.04	The HITS shall display administrator interface screens within 2 seconds of request	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.05	The HITS shall complete the display of all information on administrator screens within 10 seconds of request	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.06	The HITS shall process the email subscriber list at least once every 2 minutes	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.07	The HITS shall process the text message subscriber list at least once every 2 minutes	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.08	The HITS shall have the ability to process 5000 webpage requests per minute	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.09	The HITS shall have the ability to process 10000 video snapshot grabs from the CCTV subsystem per minute	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.03.10	The HITS shall have the ability to distribute 10,000 Email messages per minute	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

P1.03.11	The HITS shall update corridor transportation network information published to external systems at least once every 5 minutes	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04	The HITS shall have the ability to process operator and ITS information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.01	The HITS shall process operator commands from a minimum of 20 concurrent sessions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.02	The HITS shall have the ability to process administrator commands from at least five concurrent sessions	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.03	The HITS shall have the ability to process at least 250 concurrent system information flows	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.04	The HITS shall process at least 100 concurrent public safety information flows	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.05	The HITS shall process at least 100 concurrent information flows to web servers and ISPs.	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.06	The HITS shall process 50,000 vehicle detection stations	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.07	The HITS shall process 400 CCTV cameras	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.04.08	The HITS shall process at least 250 DMS installations	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.05	The HITS shall operate under the constraints of the current Houston TranStar bandwidth availability (30Mbs, burstable to 100Mbs)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.06	The HITS shall provide user information storage for at least 500 operator/administrator users	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
P1.07	The HITS shall provide date information storage for at least 500 data exchange interfaces	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
QR1 Quality Requirements							
QR1.01	The HITS shall function seven days per week, 24 hours per day, with the exception of periods of maintenance	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
QR1.02	The HITS shall be functional at least 680 of every 720 consecutive hours (95%)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
QR1.03	The HITS web servers shall be functional at least 680 of every 720 consecutive hours (95%)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
QR1.04	Any HITS Center-to-Center communication link shall be functional at least 680 of every 720 consecutive hours (95%)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1 HITS Security Requirements							
S1.01	The HITS System shall use the TranStar firewall	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.02	The HITS shall use existing Houston TranStar security solutions to validate HITS users	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.03	The HITS System shall have the capability to manage HITS administrator and operator users	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.03.01	The HITS System shall have the capability to create, modify, and delete user accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.03.02	The HITS System shall have the capability to modify user information	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.03.03	The HITS System shall have the capability to set user passwords and password expirations	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.03.04	The HITS System shall have the capability to provide mechanism for assigning permissions to user accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.04	The HITS System shall have the capability to manage user groups	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

S1.04.01	The HITS System shall have the capability to create user groups	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.04.02	The HITS System shall have the capability to modify user groups	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.04.02.01	The HITS System shall have the capability to assign users to groups	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.04.02.02	The HITS System shall have the capability to delete users from groups	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.04.03	The HITS System shall have the capability to delete user groups	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.04.04	The HITS System shall have the capability to modify user group privileges	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.05	The HITS System shall have the capability to manage external (external to COH) users	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.05.01	The HITS System shall provide an interface for external users to create accounts for customized services	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.05.02	The HITS System shall provide an interface for external users to modify accounts for customized services	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.05.03	The HITS System shall provide an interface for external users to delete accounts for customized services	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.05.04	The HITS System shall provide an interface for a HITS administrator to delete accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.06	The HITS shall have the capability to manage data interchange services	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.06.01	The HITS shall have the ability to create information interchange accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.06.02	The HITS shall have the ability to modify information interchange accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.06.03	The HITS shall have the ability to delete information interchange accounts	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.07	The HITS should have system backup and restore tools	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
S1.08	The HITS shall provide workstation backup and restore tools	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
EX1	HITS External System Requirements						
EX1.01	The HITS shall comply with all TranStar IS infrastructure	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.01.01	The HITS shall comply with TranStar IS security systems and firewalls	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.01.02	The HITS shall comply with TranStar network infrastructure	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.01.03	The HITS shall comply with TranStar power systems (normal and backup)	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.02	The City of Houston and TranStar partner agencies and any other agencies participating in the HITS shall ensure that operating agreements defining conditions for receiving transportation network information are in place	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.03	The City of Houston, TranStar partner agencies and any other agencies participating in the HITS shall have operating agreements regarding HITS control of transportation management systems	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.04	The City of Houston, TranStar partner agencies and any other agencies participating in the HITS shall prepare HITS operational procedures	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.05	The City of Houston shall prepare an HITS maintenance and enhancement plan	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.06	The City of Houston shall prepare system administration policy and procedures	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		

EX1.07	The City of Houston and TranStar agency partners shall include HITS in center disaster recovery plans	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.08	The City of Houston shall prepare an HITS staffing plan	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.09	The City of Houston shall prepare an HITS security plan (which may correspond to existing TranStar security policies)	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
EX1.10	The City of Houston shall train system administrators on the HITS security plan	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
TD1	Training and Documentation						
TD1.01	The HITS Developer shall provide operator user manuals	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.01.01	The HITS Developer shall provide hardcopy system operator user manuals	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.01.02	The HITS Developer shall provide electronic system operator user manuals	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.02	The HITS Developer shall prepare "train the trainer" course and documentation	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.02.01	The HITS Developer shall prepare a "train the trainer" course for HITS operators, maintenance and administrators	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.02.02	The HITS Developer shall prepare a "train the trainer" user manuals for HITS operators, maintenance and administrators	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.02.03	The HITS Developer shall conduct two "train the trainer" courses for HITS operators, maintenance and administrators	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.03	The HITS Developer shall train COH operators (or other staff as assigned) on HITS system use (2 courses)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.04	The HITS Developer shall provide maintenance documentation	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.05	The HITS Developer shall train maintenance staff	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.06	The HITS Developer shall provide an administrator user manual	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.07	The HITS Developer shall train system administrators	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.08	The HITS Developer shall provide an on-line user manual for public users (how to use the interface, what the output means, etc.)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.09	The City of Houston will document system enhancements	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
TD1.10	The City of Houston will document system modifications	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
TD1.11	The HITS shall provide a permanent outdoor training lab at Houston TranStar (or other City of Houston location)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.11.01	The HITS shall provide a fully operational DMS	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.11.02	The HITS shall provide a fully operational CCTV	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.11.03	The HITS shall provide a fully operational midblock counter	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.11.04	The HITS shall provide a fully operational enhanced detection	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.11.05	The training lab shall simulate actual operations of a typical installation for each device	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.11.06	The training lab shall tie into the central software system	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.11.07	The central software systems shall be configured to conduct full operations of each device in a "test" setting separate from typical live operations	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

TD1.11.08	The HITS developer shall provide a 1 page (double sided is acceptable) laminated maintenance and troubleshooting guide for each ITS device deployed - 10 copies of each	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
TD1.12	The HITS developer shall provide as a deliverable a list of parts (make, model, full description) of system parts for spares to maintain the system	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1	HITS System Ongoing Lifecycle Requirements						
LC1.01	The City of Houston shall designate a primary contact for HITS project management	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
LC1.02	The City of Houston shall designate a primary contact for HITS technical system operation	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
LC1.03	The City of Houston shall designate an HITS policy committee that will interface with TranStar Leadership Team and Executive Committees	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
LC1.04	The HITS Developer shall deliver documents required for the systems engineering process	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.01	The HITS Developer shall deliver for approval a revised concept of operations as needed	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.02	The HITS Developer shall deliver for approval a revised systems requirements document as needed	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.03	The HITS Developer shall deliver for approval a high level design document	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.04	The HITS Developer shall deliver for approval a detailed design document	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.05	The HITS Developer shall deliver for approval a subsystem verification plan document	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.06	The HITS Developer shall deliver for approval a subsystem verification plan document	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.07	The HITS Developer shall deliver for approval a system verification plan document	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.04.08	The HITS Developer shall deliver for approval a system validation plan document	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
LC1.05	The City of Houston shall document all reviews	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
LC1.06	The City of Houston shall document all approvals	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
LC1.07	The City of Houston shall document system modification activities	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
LC1.08	The City of Houston shall document system maintenance activities	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
LC1.09	The City of Houston shall engage in configuration management of the HITS	1,2,3,4,5,6,7	Con Ops Section 7	High	City of Houston		
DMS	HITS DMS Requirements						
DMS.01	The HITS shall provide DMS with full matrix display	5	Con Ops Section 7	High	HITS System		
DMS.02	The HITS shall provide DMS with 12" character height	5	Con Ops Section 7	High	HITS System		
DMS.03	The HITS shall provide DMS with 3 lines	5	Con Ops Section 7	High	HITS System		
DMS.04	The HITS shall provide DMS with Min 20 characters per line	5	Con Ops Section 7	High	HITS System		
DMS.05	The HITS shall provide DMS with 30 degree viewing angle	5	Con Ops Section 7	High	HITS System		
DMS.06	The HITS shall provide DMS with LED display	5	Con Ops Section 7	High	HITS System		
DMS.07	The HITS shall provide full color DMS	5	Con Ops Section 7	High	HITS System		
DMS.08	The HITS shall provide DMS capable of alternating between 2 messages	5	Con Ops Section 7	High	HITS System		

DMS.09	The HITS shall provide DMS with ground access to all controllers and power supplies	5	Con Ops Section 7	High	HITS System		
DMS.10	The HITS shall deploy DMS utilizing City of Houston pole and foundation standards	5	Con Ops Section 7	High	HITS System		
DMS.11	The HITS shall provide DMS with the ability to display graphics	5	Con Ops Section 7	High	HITS System		
DMS.12	The HITS shall be capable of selecting roadway segments with DMS for presentation of current sign display messages	5	Con Ops Section 7	High	HITS System		
DMS.13	The HITS shall be capable of selecting groups of DMS for presentation of current sign display messages	5	Con Ops Section 7	High	HITS System		
DMS.14	The HITS shall be capable of displaying historical "back-up" segment travel times for DMS travel time messages	5	Con Ops Section 7	High	HITS System		
DMS.15	The HITS shall provide DMS with 20 mm pixel spacing	5	Con Ops Section 7	High	HITS System		
DMS.16	The HITS shall provide DMS with aluminum face and Kynar coating	5	Con Ops Section 7	High	HITS System		
DMS.17	The HITS shall provide DMS with Lexan glazing	5	Con Ops Section 7	High	HITS System		
DMS.18	The HITS shall provide DMS that is NTCIP compliant	5	Con Ops Section 7	High	HITS System		
DMS.19	The HITS shall provide DMS with lift-face water-tight construction	5	Con Ops Section 7	High	HITS System		
DMS.20	The HITS shall provide DMS that can be opened by a single operator	5	Con Ops Section 7	High	HITS System		
DMS.21	The HITS shall provide DMS with feedback from sensors for temperature	5	Con Ops Section 7	High	HITS System		
DMS.22	The HITS shall provide DMS with feedback from sensors for humidity	5	Con Ops Section 7	High	HITS System		
DMS.23	The HITS shall provide DMS with feedback from sensors for light	5	Con Ops Section 7	High	HITS System		
DMS.24	The HITS shall provide DMS with feedback from sensors for power supplies	5	Con Ops Section 7	High	HITS System		
DMS.25	The HITS shall provide DMS with feedback from sensors for surge protectors	5	Con Ops Section 7	High	HITS System		
DMS.26	The HITS shall provide DMS with heat tape for defogging	5	Con Ops Section 7	High	HITS System		
DMS.27	The HITS shall provide DMS with true message verification for operators	5	Con Ops Section 7	High	HITS System		
DMS.28	The HITS shall provide DMS with surge protection	5	Con Ops Section 7	High	HITS System		
DMS.29	The HITS shall provide DMS with redundant power supplies	5	Con Ops Section 7	High	HITS System		
DMS.30	The HITS shall provide DMS with adequate ventilation	5	Con Ops Section 7	High	HITS System		
MB	HITS Mid-Block Count Station Requirements						
MB.01	The HITS shall provide radar based mid-block count stations	1,2,3,6,7	Con Ops Section 7	High	HITS System		
MB.02	The HITS shall provide mid-block count stations with built-in camera	1,2,3,6,7	Con Ops Section 7	High	HITS System		
MB.03	The HITS shall provide mid-block count stations with Bluetooth capability	1,2,3,6,7	Con Ops Section 7	High	HITS System		
MB.04	The HITS shall provide mid-block count stations capable of operating on smart phone	1,2,3,6,7	Con Ops Section 7	High	HITS System		
MB.05	The HITS shall provide mid-block count stations with alarms	1,2,3,6,7	Con Ops Section 7	High	HITS System		
MB.06	The HITS shall provide mid-block count stations with the ability to store a minimum of 3 months of data locally in the case of communication failure	1,2,3,6,7	Con Ops Section 7	High	HITS System		
MB.07	The HITS shall provide mid-block count stations with the ability to synchronize locally stored data with central database upon reestablishment of communications	1,2,3,6,7	Con Ops Section 7	High	HITS System		
MB.08	The HITS shall provide mid-block count stations with the ability to climate abnormal counts (planned events, incidents, etc.) when calculating average 15 min, daily, monthly, annual etc. counting reports	1,2,3,6,7	Con Ops Section 7	High	HITS System		

ED HITS Enhanced Detection Requirements							
ED.01	The HITS shall provide enhanced detection using either saw cut loops, magnetometers, or radar	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.02	The HITS shall provide enhanced detection using saw cut loops as first priority	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.03	The HITS shall provide enhanced detection (non-saw cut loops) having a 10% or less failure rate over a 36 month period.	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.04	The HITS shall provide enhanced detection that calculates through movement counts by lane	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.05	The HITS shall provide enhanced detection that calculates turning movement counts by lane	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.06	The HITS shall provide enhanced detection that gathers data from advanced detection loops at 300 ft	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.07	The HITS shall provide enhanced detection without the use of repeaters	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.08	The HITS shall provide enhanced detection with the ability to store a minimum of 3 months of data locally in the case of communication failure	1,2,3,6,7	Con Ops Section 7	High	HITS System		
ED.09	The HITS shall provide enhanced detection with the ability synchronize locally stored data with central database upon reestablishment of communications	1,2,3,6,7	Con Ops Section 7	High	HITS System		
CCTV HITS CCTV Requirements							
CCTV.01	The HITS shall provide digital (IP) CCTV cameras	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.02	The HITS shall provide proven CCTV cameras	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.02.01	The HITS shall provide CCTV cameras that are supported by several major Video Management Systems (VMS) vendors in use by a major public agency for ITS (including Genetec and ONSSI).	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.02.02	The HITS shall provide CCTV cameras with a significant install base in major U.S. public agencies for use in ITS	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.03	The HITS shall provide CCTV cameras that meet relevant ONVIF profiles as defined by the ONVIF Org.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.04	The HITS shall provide CCTV with proven interfaces with non-proprietary 3rd party CSIM/PSIM products	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.05	The HITS CCTV cameras shall be deployed by a contractor who completed manufacturer certification (credentials shall be submitted a proof)	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.06	The HITS shall provide CCTV cameras from a manufacturer that has certification training available from the proposed model in the greater Houston area, including a re-certification process to ensure skills are current with latest model and firmware upgrades.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.07	The HITS shall provide CCTV cameras from a manufacturer with certified installation and support personnel from multiple vendors in the greater Houston area.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.08	The HITS shall provide Safe CCTV cameras	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.08.01	The HITS shall provide CCTV cameras that meet product safety standards as defined in IEC/EN/UL 60950-1	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.08.02	The HITS shall provide CCTV cameras that meet product safety standards as defined in IEC/EN/UL 60950-22	4,5,7	Con Ops Section 7	High	HITS System		

CCTV.09	The HITS shall provide CCTV cameras that follow EMC approvals	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.09.01	The HITS shall provide CCTV cameras with FCC Part 15 - Subpart A approval	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.09.02	The HITS shall provide CCTV cameras with ICES-003 Class A approval	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.09.03	The HITS shall provide CCTV cameras with KN22 Class A approval	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.09.04	The HITS shall provide CCTV cameras with KN24 approval	4,5,7	Con Ops Section 8	High	HITS System		
CCTV.10	The HITS contractor shall provide Mean Time Between Failure (MTBF) statistics for the CCTV camera	4,5,7	Con Ops Section 10	High	HITS System		
CCTV.11	The HITS shall provide CCTV cameras that meet mechanical standards	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.01	The HITS shall provide CCTV cameras that meet IEC/EN 60529 IP66	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.02	The HITS shall provide CCTV cameras that meet IEC/EN 62262 IK08	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.03	The HITS shall provide CCTV cameras that meet IEC60068-2-1	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.04	The HITS shall provide CCTV cameras that meet IEC60068-2-2	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.05	The HITS shall provide CCTV cameras that meet IEC60068-2-6	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.06	The HITS shall provide CCTV cameras that meet IEC60068-2-14	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.07	The HITS shall provide CCTV cameras that meet IEC 60068-2-27	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.08	The HITS shall provide CCTV cameras that meet IEC 60068-2-78	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.11.09	The HITS shall provide CCTV cameras that meet ISO4892-2	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.12	The HITS shall provide CCTV cameras that meet sensor/optic standards	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.12.01	The HITS shall provide CCTV cameras equipped with a progressive scan sensor	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.12.02	The HITS shall provide CCTV cameras equipped with a lens providing autofocus functionality	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.12.03	The HITS shall provide CCTV cameras that provide Day/Night functionality	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.12.03.01	The HITS shall provide CCTV cameras equipped with a removable IR-cut filter	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.12.03.02	The HITS shall provide CCTV cameras that provide images down to 0.2 lux in color and 0.02 lux in B/W	4,5,7	Con Ops Section 8	High	HITS System		
CCTV.12.04	The HITS shall provide CCTV cameras that provide 30x optical zoom.	4,5,7	Con Ops Section 10	High	HITS System		
CCTV.12.05	The HITS shall provide CCTV cameras that provide 12x digital zoom.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.13	The HITS shall provide CCTV cameras that incorporate Automatic and Manual White Balance	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.14	The HITS shall provide CCTV cameras that is equipped with an electronic shutter	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.15	The HITS shall provide CCTV cameras that provide backlight compensation	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.16	The HITS shall provide CCTV cameras with a function for optimization of low light behavior.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.17	The HITS shall provide CCTV cameras that provide Image Stabilization functionality	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.18	The HITS shall provide CCTV cameras that provide adjustable defog functionality in order to get a clear image in scenes with fog	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.19	The HITS shall provide CCTV cameras that provide simultaneous Motion JPEG and H.264 video streams.	4,5,7	Con Ops Section 7	High	HITS System		

CCTV.20	The HITS shall provide CCTV cameras that support Motion JPEG encoding in a selectable range from 1 up to 30 frames per second in all resolutions.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.21	The HITS shall provide CCTV cameras that support Main or High Profile H.264 encoding with motion estimation and context-adaptive binary arithmetic coding (CABAC) in up to 30 frames per second in all resolutions.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.22	The HITS shall provide CCTV cameras that support both Maximum Bit Rate (MBR) and Variable Bit Rate (VBR) in H.264, with a configurable cap via a 3rd-party VMS configuration tool.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.23	The HITS shall provide CCTV cameras that provides the capability to choose a variety of I-frame intervals via a 3rd-party VMS configuration tool	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.24	The HITS shall provide CCTV cameras that support multiple image quality / compression setting via a 3rd-party VMS configuration tool.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.25	The HITS shall provide CCTV cameras that are equipped with a RJ45 10BASE-T/100BASE-TX PoE Ethernet port.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.26	The HITS shall provide CCTV cameras with Pan-Tilt-Zoom capabilities	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.26.01	The HITS shall provide CCTV cameras that provide at least 255 manually set preset positions.	4,5,7	Con Ops Section 8	High	HITS System		
CCTV.26.02	The HITS shall provide CCTV cameras with a guard tour functionality which allows the camera to automatically move between selected presets using an individual speed and viewing time for each preset.	4,5,7	Con Ops Section 10	High	HITS System		
CCTV.26.03	The HITS shall provide CCTV cameras with on-screen directional indicator (OSDI) functionality.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.26.04	The HITS shall provide CCTV cameras capable of panning 360 degrees (continuous 360 degree panning)	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.26.05	The HITS shall provide CCTV cameras capable of tilting +20 to -90 degrees	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.26.06	The HITS shall provide CCTV cameras designed to provide an image up to 20° above the horizon without significant loss of image quality	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.26.07	The HITS shall provide CCTV cameras with pan speed between 0.05° - 700°/sec.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.26.08	The HITS shall provide CCTV cameras with tilt speed between 0.05° - 500°/sec.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.27	The HITS shall provide CCTV cameras with the ability to provide text overlay, including date and time.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.28	The HITS shall provide CCTV cameras with the ability to apply a graphical image as an overlay image in the video stream.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.29	The HITS shall provide CCTV cameras with the ability to provide text overlay, including date and time.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.30	The HITS shall provide CCTV cameras that support both static IP addresses and addresses from a DHCP-server	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.31	The HITS shall provide CCTV cameras that incorporate support for Bonjour and other service discovery protocols.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.32	The HITS shall provide CCTV cameras that meet network standards	4,5,7	Con Ops Section 7	High	HITS System		

CCTV.32.01	The HITS shall provide CCTV cameras that meets IEEE 802.1X (Authentication)	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.32.02	The HITS shall provide CCTV cameras that meets IPv4 (RFC 791)	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.32.03	The HITS shall provide CCTV cameras that meets IPv6 (RFC 2460)	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.32.04	The HITS shall provide CCTV cameras that meets QoS – DiffServ (RFC 2475)	4,5,7	Con Ops Section 8	High	HITS System		
CCTV.32.05	The HITS shall provide CCTV cameras that supports HTTPS	4,5,7	Con Ops Section 10	High	HITS System		
CCTV.32.06	The HITS shall provide CCTV cameras that supports SSL/TLS	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.33	The HITS shall provide CCTV cameras that provide centralized certificate management	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.33.01	The HITS shall provide CCTV cameras that provide pre-installed CA certificates	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.33.02	The HITS shall provide CCTV cameras with the ability to upload additional CA certificates	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.33.03	The HITS shall provide CCTV cameras with certificates signed by an organization providing digital trust services	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.34	The HITS shall provide CCTV cameras that support IP address filtering	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.35	The HITS shall provide CCTV cameras that include at least three different levels of password security	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.36	The HITS shall provide CCTV cameras that support time synchronization via NTP server	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.37	The HITS shall provide Power to cameras	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.37.01	The HITS shall provide CCTV cameras with 100-240 VAC	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.37.02	The HITS shall provide CCTV cameras with 50-60 Hz	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.37.03	The HITS shall provide CCTV cameras with max 60 W	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.37.04	The HITS shall provide CCTV cameras with power provided to camera through the network cable by a separate injector, supplied with the camera	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.38	The HITS shall provide CCTV cameras that provide a log file	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.38.01	The HITS shall provide CCTV cameras log file containing information about all users connecting to the unit since last restart.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.38.02	The HITS shall provide CCTV cameras log file containing information about connecting IP addresses	4,5,7	Con Ops Section 8	High	HITS System		
CCTV.38.03	The HITS shall provide CCTV cameras log file containing information about time of connections.	4,5,7	Con Ops Section 10	High	HITS System		
CCTV.39	The HITS shall provide CCTV cameras with a Watchdog functionality (that automatically re-initiate processes ore restart the unit if a malfunction is detected)	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.40	The HITS shall provide CCTV cameras that send a notification when the unit has re-booted and all services initialized.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.41	The HITS shall provide CCTV cameras that contain a built-in web server making video and configuration available in a standard browser environment using HTTP	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.42	The HITS shall provide CCTV cameras fully supported by open and published API providing necessary information for integration of functionality info 3rd party applications, such as analytics code.	4,5,7	Con Ops Section 8	High	HITS System		

CCTV.43	The HITS shall provide CCTV cameras that support the use of SDK's for integration with 3rd party systems.	4,5,7	Con Ops Section 10	High	HITS System		
CCTV.44	The HITS shall provide CCTV cameras with the ability to provide full motion video	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.44.01	The HITS shall provide CCTV cameras capable of operating below 1 Mbps (full motion)	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.44.02	The HITS shall provide CCTV cameras with adjustable throughput up to 3 Mbps.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.44.03	The HITS shall provide CCTV cameras with good video quality (no lagging, blurring, or interlacing) at throughput above and below 1 Mbps	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.45	The HITS shall provide CCTV cameras viewable from any laptop/workstation on network	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.46	The HITS shall provide CCTV cameras that maintains all setting during power outages	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.47	The HITS shall provide mounted CCTV cameras	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.47.01	The HITS shall provide CCTV cameras mounted on traffic signal pole or stand alone pole	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.47.02	The HITS shall mount CCTV cameras on top of traffic signal pole	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.47.03	The HITS shall mount CCTV cameras using standard off the shelf mounting equipment	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.47.04	The HITS shall mount CCTV cameras on extension pole to achieve greater height to avoid obstructions	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.47	The HITS shall provide CCTV cameras capable of posting snapshot on TranStar website every 1-2 minutes for each camera with date and time stamp	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.48	The HITS shall provide CCTV cameras with automated presets by time of day	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.49	The HITS shall have the capability to review video image prior to displaying on TranStar website.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.50	The HITS shall provide cameras with snapshot capability.	4,5,7	Con Ops Section 7	High	HITS System		
CCTV.51	The HITS shall provide cameras HDTV 720p at a minimum	4,5,7	Con Ops Section 8	High	HITS System		
CCTV.52	The HITS shall provide cameras that have user-selectable manual and automatic control capabilities.	4,5,7	Con Ops Section 10	High	HITS System		
VMS1 Video Management Software Requirements							
VMS1.01	The HITS shall provide video management software that is fully compatible with City of Houston Public Safety video system	4,7	Con Ops Section 7	High	HITS System		
VMS1.01.01	The HITS shall provide at least 3 agency references for the video management software	4,7	Con Ops Section 7	High	HITS System		
VMS1.02	The HITS shall provide video management software with the ability to integrate with existing video management software at the City of Houston (VIDSYS)	4,7	Con Ops Section 7	High	HITS System		
VMS1.03	The HITS shall provide video management software that is open architecture	4,7	Con Ops Section 7	High	HITS System		
VMS1.04	The HITS shall provide video management software that is scalable architecture	4,7	Con Ops Section 7	High	HITS System		

VMS1.06	The HITS shall provide video management software with failover server(s)	4,7	Con Ops Section 7	High	HITS System		
VMS1.07	The HITS shall provide video management software with central management of all disparate cameras	4,7	Con Ops Section 7	High	HITS System		
VMS1.08	The HITS shall provide all hardware for video management software	4,7	Con Ops Section 7	High	HITS System		
VMS1.09	The HITS shall provide video management software with user-defined on-screen labels for each device	4,7	Con Ops Section 7	High	HITS System		
VMS1.10	The HITS shall provide video management software with multi-monitor support	4,7	Con Ops Section 7	High	HITS System		
VMS1.11	The HITS shall provide video management software with multiple cameras able to be viewed simultaneously on a single TV and / or monitor (1, 2, 4, 6, or 8 images per screen)	4,7	Con Ops Section 7	High	HITS System		
VMS1.12	The HITS shall provide video management software with lock down non-admin users from PTZ	4,7	Con Ops Section 7	High	HITS System		
VMS1.13	The HITS shall provide video management software with drag and drop user-definable layouts	4,7	Con Ops Section 7	High	HITS System		
VMS1.14	The HITS shall provide video management software with on screen physical and digital PTZ control	4,7	Con Ops Section 7	High	HITS System		
VMS1.15	The HITS shall provide video management software with a search box allowing quick access to camera or server via partial name or IP address	4,7	Con Ops Section 7	High	HITS System		
VMS1.16	The HITS shall provide video management software that quickly navigates between cameras and servers	4,7	Con Ops Section 7	High	HITS System		
VMS1.17	The HITS shall provide video management software that exports clips in native camera compression or MPEG	4,7	Con Ops Section 7	High	HITS System		
VMS1.18	The HITS shall provide video management software has layout groups to logically group corridors and/or areas	4,7	Con Ops Section 7	High	HITS System		
VMS1.19	The HITS shall provide video management software with camera navigation tree structure	4,7	Con Ops Section 7	High	HITS System		
VMS1.20	The HITS shall provide video management software with camera search box to find any camera via name or IP address	4,7	Con Ops Section 7	High	HITS System		
VMS1.21	The HITS shall provide video management software that shows full screen or multi-camera views on one or many monitors and / or TV's	4,7	Con Ops Section 7	High	HITS System		
VMS1.22	The HITS shall provide video management software with auto discovery of cameras	4,7	Con Ops Section 7	High	HITS System		
VMS1.23	The HITS shall have the capability to black out cameras on demand	4,7	Con Ops Section 7	High	HITS System		
VMS1.24	The HITS shall have the capability to differentiate between a black out and problem camera	4,7	Con Ops Section 7	High	HITS System		
VMS1.25	The HITS shall have the capability to automatically adjust bandwidth	4,7	Con Ops Section 7	High	HITS System		
VMS1.26	The HITS shall be capable of obtaining snapshot images from each camera	4,7	Con Ops Section 7	High	HITS System		
VMS1.27	The HITS shall be capable of obtaining video on demand from each camera	4,7	Con Ops Section 7	High	HITS System		
VMS1.28	The HITS cameras shall not stream video over communications network unless requested.	4,7	Con Ops Section 7	High	HITS System		
VMS1.29	The HITS shall have the ability to have geospatial reference capability to automatically select near-by cameras	4,7	Con Ops Section 7	High	HITS System		

VMS1.30	The HITS shall provide support for Internet Protocol (IP) cameras from multiple third-party manufacturers using various codecs, including H.264, MPEG-4, and MJPEG.	4,7	Con Ops Section 7	High	HITS System		
VMS1.31	The HITS shall provide video management software that support both single and multi-site deployments	4,7	Con Ops Section 7	High	HITS System		
VMS1.32	The HITS shall provide video management software that supports a web interface	4,7	Con Ops Section 7	High	HITS System		
VMS1.33	The HITS shall provide video management application that is accessible via mobile devices (Android HTC and IOS iPhone/iPad)	4,7	Con Ops Section 7	High	HITS System		
VMS1.33.01	Mobile Device application allows a user to pick from a list of cameras and view the live video feed.	4,7	Con Ops Section 7	High	HITS System		
VMS1.33.02	Mobile Device uses same security access as web application.	4,7	Con Ops Section 7	High	HITS System		
VMS1.33.03	Mobile Device allows the user to access the camera controls remotely.	4,7	Con Ops Section 7	High	HITS System		
VMS1.33	The HITS video management software can configure number of streams that appear in a client view. Describe the limitation on performance of individual clients.	4,7	Con Ops Section 7	High	HITS System		
VMS1.34	The HITS video managemtn software shall support the following video resolutions: QCIF, CIF, 2CIF, VGA, 4CIF, HD720, SXGA, UXGA, and WQXGA.	4,7	Con Ops Section 7	High	HITS System		
T1	Transtar and Traffic Ops Maintenance Facility Electronics Requirements						
T1.01	The HITS shall provide electronics at Houston TranStar	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.01	The HITS shall provide workstations that meets Houston TranStar IS standards	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.01.01	The HITS shall provide 2 workstations in control room	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.01.02	The HITS shall provide 5 workstations on 2nd floor	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.02	The HITS shall provide TV at Houston TranStar 2nd floor	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.02.01	The HITS shall provide TV that is a minimum of 60"	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.02.02	The HITS shall provide TV that is LED	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.02.03	The HITS shall provide TV with split screen capability (1, 2, 4, 6, 8 images)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.02.04	The HITS shall provide TV that can display up to 8 simultaneous camera views	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.01.02.05	The HITS shall provide TV that is High Definition (HD)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.02.06	The HITS shall provide TV with wifi capability	1,2,3,4,5,6,8	Con Ops Section 8	High	HITS System		
T1.02	The HITS shall provide electronics at Traffic Ops Maintenance Facility (2200 Patterson)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.01	The HITS shall provide workstation capable of operating HITS system	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.02	The HITS shall provide TV	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.02.01	The HITS shall provide TV that is a minimum of 60"	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.02.02	The HITS shall provide TV that is LED	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.02.03	The HITS shall provide TV with split screen capability (1, 2, 4, 6, 8 images)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.02.04	The HITS shall provide TV that can display up to 8 simultaneous camera views	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

T1.02.02.05	The HITS shall provide TV that is High Definition (HD)	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.02.02.06	The HITS shall provide TV with wifi capability	1,2,3,4,5,6,8	Con Ops Section 8	High	HITS System		
T1.02.03	HITS shall provide switch or router at 2200 Patterson to provide access to the HITS system (maps, modules, etc.).	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.03	The HITS shall allow users to view CCTV camera views on Workstation and TV	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.04	The HITS shall allow user to select CCTV camera on desktop and display on monitor- 8 locations on 2nd floor at TranStar and 1 location 2200 Patterson	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
T1.05	HITS shall provide all cabling, connectors, etc. at Houston TranStar and 2200 Patterson to successfully deploy all electronics	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD	HITS General Field Device (DMS, CCTV, MB Count Stations, Enhanced Detection) Requirements						
GFD.01	The HITS shall provide all IP base devices	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.02	The HITS shall Utilize existing communications system	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.03	All devices shall be capable of reestablishing normal operations after communications is restored (in the event of a communications outage). These devices shall not require a field visit from a technician to re-boot, re-flash, etc. when communications is reestablished.	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.04	The HITS shall provide ITS devices that are proven	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.04.01	The HITS shall provide ITS devices with significant install base in major U.S. public agencies for ITS	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.04.02	The HITS shall provide at least 3 agency references for all ITS devices	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.05	The HITS shall provide field devices that utilize ATMS.now for central control and operations	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.06	The HITS shall provide qualified field personnel for this Project	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.06.01	The HITS Developer shall provide resumes for all personnel performing construction on this project	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.06.01.01	The HITS Project lead field personnel shall have adequate experience constructing similar ITS infrastructure	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.06.01.02	The HITS Project personnel shall have up to date certifications from manufactures to install each ITS device	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.06.02	The HITS Developer shall provide resumes for all personnel performing integration on this project	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		
GFD.06.02.01	The HITS Project lead personnel shall have adequate experience integrating similar ITS infrastructure	1,2,3,4,5,6,7	Con Ops Section 7	High	HITS System		

3.3 HITS Use Cases

Use cases are presented in this SRS as a means of further specifying the functional requirements. For each use case the user (or actor), his interaction with the system, the purpose of their interaction is presented. The use cases presented below roughly demonstrate the use of the HITS system to address each identified need as outlined in Section 1.5 of this document and in more detail in Section 7 of the *Concept of Operations*. The use cases could also be used to supplement information found in the “Operational Scenarios” as presented in Section 11 of the *Concept of Operations*. This part of the SRS documents: 1) who will be using the system and 2) what they will be using the system to accomplish.

The significant HITS system users were defined as the actors in exploring the use cases. These actors include:

- Travelers
- The City of Houston Traffic Operations Division
- Partner Agencies (Other City Agencies, METRO, TxDOT, Harris County)
- Third Party (Non-Governmental) Information Providers

For each use case a summary of the use, the preconditions, triggers, the actors, scenarios and basic course of events, and results are presented.

3.3.1 Provide Pre-Trip Traveler Information

Critical to the deployment of the HITS system is bringing arterial information in the City of Houston to the existing pre-trip traveler Info capability of the TranStar website. There is a need to provide travelers enhanced information in making arterial route choices and provide them travel time estimates.

3.3.1.1 Actors

- City of Houston HITS operators (monitors transport networks)
- Travelers

3.3.1.2 Scenario

- A traveler desires current arterial travel information

3.3.1.3 Systems Used

- TranStar Traveler Information Systems interface

3.3.1.4 Requirements

- Single “go-to” webpage for arterial travel information

3.3.1.5 Non Functional Requirements

- Handle 5000 simultaneous users
- Respond within 2 seconds

3.3.1.6 Interfaces

- TranStar Travel Time Monitoring (TTM) System (AWAM) travel times/speeds and interface to traveler information portal

- COH HEC HPD/HFD databases and interfaces
- 3.3.1.7 Result
- Traveler receives trip information based on available transport network conditions.

3.3.2 Provide En-Route Traveler Information

TranStar has very good en-route information dissemination capability for freeways and tollways between its infrastructure (the ability to push real-time traffic alerts to phones and via DMS) and through its media partners. The HITS shall use and enhance this capability so that drivers are provided with arterial information, while en-route, which will allow alternative routes to be chosen for their destination.

3.3.2.1 Actors

- City of Houston HITS operators
- Third party ISP's (primarily news outlets - disseminate traveler information from TranStar data sources and their own sources – helicopters, travel probe vehicles, etc.)
- Travelers (engaged in a trip, seeks information on status of the transport network)

3.3.2.2 Scenario

- A traveler is making a trip and receives updated network status information that could influence the remainder of the trip (travel time information or an incident)
- A traveler receives information on other available routes

3.3.2.3 Systems Used

- TranStar Traveler Information Systems
- TranStar Mobile Traveler Information Systems interface

3.3.2.4 Requirements

- TranStar webpage for travel information with mobile interface

3.3.2.5 Non Functional Requirements

- Handle 100,000 simultaneous users
- Respond within 2 seconds
- Consider mobile device requirements

3.3.2.6 Interfaces

- TranStar Transportation Monitoring System (TTM) and interface to traveler information portal
- COH HEC databases and interfaces

3.3.2.7 Result

- Traveler receives information that can be used to change a trip plan.

3.3.3 Traffic Control and System Capacity Monitoring

HITS should include a Traffic Control and Monitoring function that provides the capability to efficiently manage and monitor the movement of traffic on city

arterials. The four primary functions that should be provided are: 1) Traffic Flow Optimization, 2) Traffic Surveillance, 3) Device Control, and 4) Provide Information.

3.3.3.1 Actors

- City of Houston HITS Operators monitor system networks

3.3.3.2 Scenario

- HITS operators monitor infrastructure & system
- HITS produces information on network status (normal or abnormal) due to changes in incident condition

3.3.3.3 Systems Used

- ITS Infrastructure: field devices, communications systems, internal agency/TranStar subsystems

3.3.3.4 Requirements

- Internal COH & /TranStar ITS systems/sub-systems

3.3.3.5 Non Functional Requirements

- HITS should be able to receive data from other agencies and system/sub-systems
- HITS agency systems should update based on actions taken and poll for status regularly

3.3.3.6 Interfaces

- TranStar IS
- Agency systems/sub-systems
- C2C

3.3.3.7 Result

- Transportation network status updated to current situation

3.3.4 Maintenance and Construction Operations Support

There is the need for City of Houston operators to know maintenance and construction information through the street cut permit information system. This would support monitoring, operating, maintaining, improving and managing the physical condition of roadways, the associated infrastructure equipment, and the required resources.

3.3.4.1 Actors

- The City of Houston TranStar operator monitoring traffic operations where maintenance and construction may disrupt network flow.

3.3.4.2 Scenario

- COH permits a construction/maintenance activity (city or private entity).
- If HITS senses abnormal volume or travel time/speed conditions, the operator can check if permitted maintenance
- The operator can then check its alarms against permitted activity.

- Proper traveler information systems are employed to make travelers aware of the activity.
- 3.3.4.3 Systems Used
- TranStar/HITS IS Capability and Infrastructure
 - C2C interfaces (GIMS)
 - ATMS.now alarms
 - TranStar webpage
- 3.3.4.4 Requirements
- COH input of construction and maintenance activity and schedules through GIMS
 - HITS pull of GIMS Street Cut Permit Data
- 3.3.4.5 Non Functional Requirements
- None
- 3.3.4.6 Interfaces
- Existing Construction Information Systems (pull from GIMS)
 - Operator interface through ATMS.now.
- 3.3.4.7 Result
- Ability to monitor and disseminate construction and maintenance activities to users.

3.3.5 Archived ITS/HITS Data for Planning Activities

HITS needs to provide an Archived Data function to control the archiving and distribution of ITS data. The Archived Data User Service would provide the Historical Data Archive Repositories and controls the archiving functionality for all ITS/HITS data. This is needed in support of performance monitoring efforts.

- 3.3.5.1 Actors
- City of Houston
 - Houston-Galveston Area Council
 - TranStar Partner Agencies
 - TranStar/H-GAC/TTI Data Warehouses
- 3.3.5.2 Scenario
- H-GAC requests traffic volume and travel time data from the City of Houston
 - COH grants H-GAC access to the HITS archive to export data as needed
- 3.3.5.3 Systems Used
- TranStar/HITS IS Capability and Infrastructure
 - HITS data export
- 3.3.5.4 Requirements
- Security-enabled login for remote users
- 3.3.5.5 Non Functional Requirements
- System must interface with existing systems and interface specifications and be able to output to specified file formats or report forms.

3.3.5.6 Interfaces

- TranStar/HITS IS Infrastructure
- ATMS.now
- Travel Time monitoring system

3.3.5.7 Result

- Archived information is stored for planning or other purposes with the ability to export to internal or external uses

3.4 Physical Requirements

3.4.1 Construction

The HITS system will consist of bringing together a system of sub-systems, and will be housed at Houston TranStar. The computer hardware and software should comply with TranStar IS requirements and any furniture or space requirements should be specified by TranStar IS. The HITS system graphical user interfaces should be designed to be viewed on existing operating systems and platforms as specified by TranStar IS and compliant with the City's central software system, ATMS.now.

3.4.2 Durability

The HITS system, consisting of computer equipment and databases, should be specified to the requirements of TranStar IS, including their durability characteristics.

3.4.3 Adaptability

The HITS system should be designed such that it could be expanded regionally, using applicable standards and regionally approved ITS Architecture. It should be fully scaleable and expandable, including bandwidth, rack space and to new workstations.

3.4.4 Environmental Conditions

The environmental conditions that the HITS system must operate should be specified by TranStar IS at the time of detailed design.

3.5 User Requirements

The details about the HITS screens that the operating agencies will look like are summarized in this section.

3.5.1 The City of Houston Manager/Operator

The City of Houston staff (manger and/or operator) likely have similar requirements of the HITS information provided to them. They first need to be able to see the information they are providing to the public, in the form in which they are providing it. But secondly, and most importantly, they need to see additional detailed performance indicators for their systems, and for other networks (primarily freeway/tollway facilities in proximity to their arterial network). The information that should be provided to the COH manager/operators include:

- Freeways, HOVL/Managed Lanes, Arterials
 - Link travel times
 - Link congestion levels
 - Link volumes, occupancies, spot speeds
 - Intersection approach volumes
- ITS Equipment (locations, ID, operational status)
 - CCTV images
 - AWAM system operations
 - DMS operations/messages
 - Traffic signal status, & operational mode
- Systemwide ITS Data
 - Video images & control
 - Incident location, status, details
 - Maintenance & construction events, status
 - Special events, status

Many of these items already have a defined interface that would not have to be changed for HITS. However, several of these items will need an interface (either through ATMS.now or a new system).

3.5.2 The Traveler

The traveler information portals may vary in form depending on when they access the traveler information and from where, be it an internet site on a personal computer or via a personal digital device. Currently, travelers can reach the available traveler information through all of these means through the Houston TranStar website.

3.5.2.1 Pre-Trip

This system interface would be similar to existing TranStar personalized traveler information. The HITS system may have to use greater resolution to provide traveler information via map by requiring the user to zoom into particular areas on the “black background” map. On the Bing maps interface, the zoom should be intelligent based on the amount of visualization that can be provided at a certain zoom level.

3.5.2.2 During Trip – Roadside

Travel information via DMS should be done similar to what is done today on the freeway system.

3.5.2.3 During Trip - In-Vehicle

Travel information via PDA or broadcast media – must be simplified due to driver workload requirements, must state very basic information, similar to what is currently provided (simple color-coded traffic maps) updated during the trip.

3.5.3 *System States and Modes*

Since the HITS system would be an integration of individual subsystem ITS elements, failure in one network should not render the HITS system inoperable. When accessing HITS-type data, the traveler should be presented with information even though the entirety of ITS data may not be available. This is done now on the TranStar traffic map with the indication of gray for segments where travel speed information is unavailable. Similar messages should be developed when incomplete system data is requested. Another option in the case of missing data would be to request “historic” data (from that day and time) to complete a “synthetic” travel-time. This is currently done for some other TranStar traveler information products.

At a minimum, the HITS system should indicate whether a portion of the network is available for travel (e.g., present an incident if closed), and the additional traveler information provided if available.

There may be times when the system is shut-down for maintenance or modified for operations during emergency conditions (during hurricane evacuations to preserve bandwidth, for example). Simple text messages should replace the normal web-based pages to inform the user that the service is unavailable during those outages, whether planned or unplanned.

3.6 *Information Management Requirements*

The HITS system shall comply with existing TranStar information management requirements pertaining to control over data structure, processing, delivery and archival processes.

3.7 *Systems Requirements*

3.7.1 Performance Requirements

The HITS system should be able to receive, process, and distribute HITS data to City of Houston workstations and servers, and have the ability to receive, process and distribution information to external systems including other TranStar public agencies and preferred 3rd party ISP's within 30 seconds of any request.

The maximum number of concurrent public users to the system should be at least 50,000 individual sessions and the system should be able to respond to any public user request within two minutes of a request, and should actively show system status while processing (via % complete, active icon, etc.).

The HITS system shall be designed to support an unlimited number of public agency terminal users concurrently. The HITS system should be given priority for incident and emergency management use by agency staff, with secondary priority for public user use under atypical conditions.

3.7.2 *Quality Requirements*

The HITS system shall satisfy specifications and fulfill the system user's mission objectives in the most correct and efficient manner practically possible. The software code shall be designed to minimize the amount of computing resources necessary to perform the intended function. The system should be designed with flexibility to minimize the effort needed to modify the operational program.

The HITS system should be designed so that various levels of security exist for system administrators and users. It will be necessary to provide system integrity and built-in security so that access to software or data by unauthorized people can be controlled. The system should be protected from accidental or malicious access, use, modification, and destruction. Specific requirements could include the need to:

1. Restrict access to system
2. Utilize certain cryptographic techniques
3. Keep log or history files
4. Assign certain functions to different modules
5. Restrict communications between some areas of a program
6. Check data integrity for critical variables
7. Use passwords for console operation.
8. Check summing of communication packets.
9. Restrict access to licensed software

Developers should provide a front-end to allow a single sign-on to control access to a variety of systems that TranStar or agency personnel will continue to access. The systems to be accessed include a variety of platforms including client/server, web-based and mainframe systems. The system shall incorporate appropriate security measures when processing system data and limit system accesses to authorized users and restrict user capabilities according to an individual-specific profile. The program should provide a variety of security options including software application, window, and field level security and support varying degrees of confidentiality between programs with regard to retrieval, change, and display of data.

The HITS system should be designed modularly with a key aspect being interoperability between systems and system users to minimize the effort needed to couple one system with another. The system should also be designed modularly so that minimal effort is required to locate and fix an error during operation. The entire system should not have to be taken off-line to fix a majority of errors.

The HITS system should be designed and coded using industry accepted tools, languages, and standards so that portability between hardware or software environments is possible without redesigning or recoding the system.

The HITS system should be reliable in availability and function (to 99.99%). It should include functions that provide testability to ensure that the system is performing as intended (that communications and C2C interfaces are active and that system output lies within acceptable ranges).

The HITS system should be designed and implemented with minimal effort required to learn, operate, prepare input, and interpret output. The system should be available and accessible to agency users 99.5% of the time. It should be available to the public 98% of the time.

3.8 Policy and Regulation Requirements

The HITS System is subject to the existing policies and practices of the City of Houston and TranStar partner agencies. However, new policies and procedures may be necessary when linking via C2C to the City of Houston Emergency Center and other systems. Concerns of security and privacy must be considered in linking these systems.

3.9 System Life Cycle Sustainment Requirements

The HITS system performance (not the performance of the transportation system in response to HITS operation) should be monitored to ensure that the system is functioning properly over time. System use should also be monitored so that the most frequently used portions of the HITS system can be maintained with the highest reliability and performance. If degradation in system performance is noted (by latency issues, user complaints, etc.), the City of Houston should consider upgrading servers and communications links accordingly.

Section 4. System Interfaces

This brief section specifies the interfaces among existing agency systems and HITS system components. The HITS is fortunate in that many of the interagency systems and subsystems are already part of the TranStar IS infrastructure, so a majority of the effort would be in creating new electronic infrastructure and not physically attaching the systems and subsystems.

Description	Priority	Comments
HITS will be connected to the City of Houston Emergency Center	High	Critical, xml/html Interface
HITS will access the City’s AWAM TTM system data interface	High	Critical, data interface
The HITS sub-system will be integrated into the TranStar Data Warehouse	High	Critical, Internal TranStar Interface
All or some portion of the HITS data will be provided to Third Party ISPs via HITS-External Interface (using existing data agreements)	High	Critical, Internal TranStar Interface
HITS Multiagency Operational Interfaces to existing TranStar consoles and terminals	High	Critical, Internal TranStar Interface

Section 5. References

This section provides a list of the significant documents and other sources of information used in the development of the SRS.

Concept of Operations for the Houston Intelligent Transportation System (HITS) Project, Version 1.1, City of Houston and Texas A&M Transportation Institute, Houston, Texas, January 2016.

Systems Engineering

“Systems Engineering Guidebook for ITS,” California Department of Transportation, Division of Research & Innovation, Version 1.1, February 14, 2005.

IEEE Guide for Information Technology - System Definition-Concept of Operations (ConOps) Document, IEEE Std 1362-1998.

Intelligent Transportation Systems and Architecture

FHWA Rule 940, Federal Register Volume 66, No. 5, Monday, January 8, 2001, Rules and Regulations, Department of Transportation, Federal Highway Administration 23 CFR Parts 655 and 940, RIN 2125–AE65 Intelligent Transportation System Architecture and Standards.

System Manuals

ATMS.now User Operations Manual, Version 2.4, Build 4.5.x, September 2015, Trafficware/Naztec, Sugar Land, Texas.

Section 6. Glossary

Define of all terms and acronyms required to interpret the SRS properly.

Section 7. Revision History

Version	Date	Name	Description
1.0	1/19/2016	System Requirements for the City of Houston Intelligent Transportation System (HITS)	Initial Draft