

Exhibit D

Exhibit 7

ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
1	ATMS - CENTRAL SYSTEM (GENERAL REQUIREMENTS)							
	KITS - Kimley-Horn Integrated Transportation System							
1.1	Provide real time two-way traffic signal communications so that staff can use this data to adjust signal timing.	Y						
1.2	Provide monitoring capability in graphical and text formats	Y						
1.3	Provide general operational configuration	Y						
1.4	Provide a Commercial Off the Shelf (COTS) solution	Y						
1.5	Provide diagnostic capabilities to notify staff about traffic signal malfunction	Y						
1.6	Be able to identify the problem and issue an electronic incident ticket to the City's Remedy or CRM system.			Y				Software development required. Additional detail can be found in Task 5 of scope of work
1.7	Allow staff to address certain traffic signal issues remotely- can remotely change signal timing	Y						
1.8	Be capable of proactively monitor traffic congestion.	Y						
1.9	Be capable of alerting the Traffic Management Center if traffic frequently backs up or if time to drive down an arterial increases significantly which will allow staff to react rapidly to developing situations.	Y						
1.10	Be capable of incorporating new traffic management applications as they are developed in the future without requiring wholesale system replacement.	Y						
1.11	Provide capability for inter-jurisdictional compatibility; and regional cooperation through data sharing and emergency management.		Y					KITS will be deployed to include existing TxDOT C2C functionality. Collaboration, configuration and integration will be performed in a future project phase
1.12	Be capable of viewing and controlling traffic monitoring video cameras	Y						
1.13	Be capable of managing signal timing data for over 2000 signals in the system	Y						
1.14	Be capable of collecting traffic data from individual signals	Y						
1.15	Aids in traffic signal maintenance and equipment tracking	Y						
1.16	The ATMS Traffic Signal System shall provide a single interface between the traffic signal controllers in the field and the users of the system.	Y						
1.17	The ATMS Traffic Signal System shall be capable of communicating with the following minimum number of field devices							
1.17.1	2,000 Signalized Intersections	Y						

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1.17.2	1,000 Control Sections	Y						
1.17.3	15,000 System Detectors	Y						
1.17.4	1,000 Video devices (CCTV cameras or other digital video encoding devices)	Y						
1.18	SUPPORT LOCAL CONTROLLERS	Y						
1.18.1	The ATMS Traffic Signal System shall be fully compatible with the Local Controller firmware/software	Y						
1.18.2	The ATMS Traffic Signal System shall be capable of Uploading/Downloading all editable data entries used by the Local Controller firmware	Y						
1.18.2.1	The ATMS Traffic Signal System shall not upload/download controller parameters, such as cabinet configuration data without the expressed desire of the user.	Y						
1.18.2.2	Upload/download shall be verified	Y						
1.18.2.2.1	Non-verified data shall cause termination of the upload/download with no data transfer taking place.	Y						
1.18.3	Upload and download actions from central system shall not cause the controller to go off-line (unless the communication parameters are changed).	Y						
1.18.4	Following an upload, the operator shall be able to compare field and central data for each controller	Y						
1.18.5	The System Operator shall be able to download data from the field and store it in the central system	Y						
1.18.5.1	The System Operator shall be able to upload and download individual controller configuration information	Y						
1.18.5.2	The System operator shall be able to export timing data to an Excel compatible format.	Y						
1.18.5.3	The system operator shall be able to import timing data from an Excel compatible format.	Y						
1.18.5.4	The ATMS Traffic Signal System shall allow multiple users to view configuration information, but only one user has edit and save permissions.	Y						
2	ATMS - CENTRAL SYSTEM (FUNCTIONAL REQUIREMENTS)							
2.1	TRAFFIC CONTROL							
2.1.1	The ATMS Traffic Signal System shall provide mode control on the following basis:							
2.1.1.1	Intersection/Controller	Y						
2.1.1.2	Section/Control Group	Y						

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2.1.1.3	Zone/Area	Y						
2.1.1.4	System-Wide	Y						
2.1.2	The ATMS Traffic Signal System shall provide the following operator-selectable control modes for system control for the specified controller(s), section(s), zone(s), or system.	Y						
2.1.2.1	Manual Control - The operator shall be able to manually override the plan that the system, zone, section, or intersection is currently running	Y						
2.1.2.1.1	The Operator shall be able to initiate and release manual control manually, via the user interface	Y						
2.1.2.1.2	The Operator shall be able to schedule the initiation and termination of Manual Control	Y						
2.1.2.2	Free – The Controller, section, zone or system shall operate without coordination.	Y						
2.1.2.3	Flash – The ATMS Traffic Signal System shall command the controller, section, zone, or system to flash	Y						
2.1.2.4	Scheduled Time-of-Day (TOD) operation following the Local Controller's schedule	Y						
2.1.3	The ATMS Traffic Signal System shall have an event scheduler that can schedule commands for devices as well as internal system operations based on time and date.	Y						
2.1.3.1	Events must be scheduled to occur on any combination of the day of the week, a particular date, or whether the day is a (user-definable) holiday.	Y						
2.1.3.2	The start time and stop time must both be specified with both a date and time	Y						
2.1.3.3	The ATMS Traffic Signal System shall support up to one thousand (1,000) programmable time of year (TOY) events	Y						
2.1.3.4	The ATMS Traffic Signal System shall support up to one thousand (1,000) programmable time of day/day of week (TOD/DOW) events	Y						
2.1.3.5	The system shall be able to schedule system commands for the specified controller(s), section(s), zone(s), or system., including the following:	Y						
2.1.3.5.1	Go to Flash	Y						
2.1.3.5.2	Go to Free	Y						
2.1.3.5.3	Run off local schedule	Y						
2.1.3.5.4	Run a pattern	Y						
2.1.3.5.5	Run a defined list of multiple actions	Y						

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No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.1.3.5.6	Turn special function on	Y						
2.1.3.5.7	Turn special function off	Y						
2.1.3.5.8	Turn on transit signal priority	Y						
2.1.3.5.9	Turn off transit signal priority	Y						
2.1.3.5.10	Enable/disable traffic responsive operation	Y						
2.1.3.5.11	Override current traffic responsive plan	Y						
2.1.3.5.12	Make local controller active or inactive	Y						
2.1.3.5.13	Generate alarm report	Y						
2.1.3.5.14	Clear a specific log	Y						KITS logs can be deleted or archived
2.1.3.5.15	Broadcast time	Y						
2.1.3.6	The system shall be able to schedule system commands for the following internal system operations (at minimum):	Y						
2.1.3.6.1	Turn messaging on or off	Y						
2.1.3.6.2	Synchronize workstation and device clocks	Y						
2.1.3.6.3	Get the failure log for the server	Y						Event log reports can be scheduled
2.1.4	The scheduler shall include multiple time-of-day/day-of-week (TOD/DOW) schedules	Y						
2.1.4.1	TOD/DOW schedules shall have one minute resolution	Y						
2.1.4.2	Multiple TOD/DOW schedules should be able to be active at one time	Y						
2.1.5	System Operators shall be able to schedule system commands one year in advance	Y						
2.1.6	All Manual Operator commands shall have priority over scheduled entries in the scheduler.	Y						
2.1.7	The Scheduler shall be able to schedule and execute multiple commands for the same defined time	Y						
2.1.8	The Scheduling capability shall include the ability to schedule permanent and temporary events	Y						
2.1.8.1	Permanent commands shall be performed every time the matching of time parameters occurs	Y						
2.1.8.2	Temporary commands shall be performed once and then be deleted from the scheduler database	Y						
2.1.9	The ATMS Traffic Signal System shall include a permanent schedule that defines fixed and floating holidays	Y						
2.1.9.1	It shall be possible to override TOD/DOW plans with Holiday/Exception day plans	Y						

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2.2	ACCESS	Y						
2.2.1	The ATMS Traffic Signal System shall support a multi-terminal, multi-user interface to the system.	Y						
2.2.1.1	The ATMS Traffic Signal System shall allow access to multiple levels of the system simultaneously	Y						
2.2.2	The ATMS Traffic Signal System shall support at least 25 concurrent users	Y						
2.3	ALARMS	Y						
2.3.1	The ATMS Traffic Signal System shall be capable of providing alarms to System Operators	Y						
2.3.2	The ATMS Traffic Signal System shall monitor intersection devices, detectors, and communication channels for errors.	Y						
2.3.3	The ATMS Traffic Signal System shall have user selectable alarms based off any event generated in the controller. The Respondent shall identify all of the alarms/alerts that are supported by the controller and central software	Y						
2.3.4	Alarms shall be configurable for both persistence (number of occurrences within a specified time period) and duration (trigger only after triggering event is active for specified duration).	Y						
2.3.5	Alarms shall be transmitted to each TOC and active system operators	Y						
2.3.6	Alarms shall be capable of being acknowledged from any authorized user	Y						
2.3.7	All alarms and acknowledgements shall be logged	Y						
2.3.8	The ATMS Traffic Signal System shall allow the System Administrator to configure the recipients of alarm notification.	Y						
2.3.8.1	The System Administrator shall be able to configure the method of notification on a per alarm and per recipient basis	Y						
2.3.8.1.1	The ATMS Traffic Signal System shall be capable of sending alarms through SMS to the designated recipients.	Y						Requires collaboration with ITSD to allow outbound email messaging from KITS servers
2.3.8.1.2	The ATMS Traffic Signal System shall be capable of sending alarms through email to the designated recipients	Y						
2.3.8.2	The System Administrator shall be able to configure the recipients of alarms by TOD/DOW	Y						
2.3.9	The System Administrator shall be able to establish alarm notification by group members	Y						
2.3.10	The ATMS Traffic Signal System shall provide at least the following alerts	Y						

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2.3.10.1	Conflict Flash	Y						
2.3.10.2	Local Flash	Y						
2.3.10.3	Commanded Flash	Y						
2.3.10.4	Preempt	Y						
2.3.10.5	Local Free	Y						
2.3.10.6	Prioriters	Y						
2.3.10.7	Controller Keyboard Press							It does not appear that NextPhase 1.7.7 supports this functionality through NTCIP.
2.3.10.8	Communication failure/resumption	Y						
2.3.10.9	Door open							It does not appear that NextPhase 1.7.7 supports this functionality through NTCIP.
2.3.10.10	Laptop computer connected to controller							It does not appear that NextPhase 1.7.7 supports this functionality through NTCIP.
2.3.10.11	Power failure/restoration	Y						
2.3.10.12	Detector failures	Y						
2.3.10.13	Arrivals on red above a specified threshold for an approach	Y						Detector configuration by City required
2.3.11	The ATMS Traffic Signal System shall be capable of allowing SMS messages and emails to designated recipients	Y						
2.3.12	All sent SMS messages and emails shall be logged	Y						
2.3.13	The ATMS Traffic Signal System shall be capable of sending multiple SMS messages/emails within a few seconds of each other.	Y						
2.3.14	SMS messages/emails shall be sent within 60 seconds of the event.	Y						
2.3.15	The system software must be able to be commanded from the event scheduler to monitor the real-time phase status of a traffic signal controller unit to ensure that its operation is within proper constraints of the timing plan that is in effect.	Y						
2.3.15.1	The software shall use the central database timing parameters to check against the phase returns.	Y						
2.3.15.2	Through compliance monitoring, the error conditions, which shall be detected, include the following:	Y						
2.3.15.2.1	The controller is not using the proper timing plan	Y						
2.3.15.2.2	The controller time clock is out of synchronization	Y						
2.3.15.2.3	The controller is not sequencing	Y						

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2.3.15.2.4	The phase sequence is improper	Y						
2.3.15.2.5	Phase time compliance	Y						
2.3.15.3	Pre-emption occurrences shall not be interpreted as an error condition.	Y						
2.4	CONTROLLER CONFIGURATION INTERFACE	Y						
2.4.1	The interface used to edit and view the local controller configuration shall be integrated with the ATMS Traffic Signal System.	Y						
2.4.2	The central system application shall be used to store all data used by the ATMS Traffic Signal System.	Y						
2.4.2.1	The system should also store the central copies of the current timing plans for each of the configured intersections.	Y						
2.4.2.2	The system shall store multiple versions of the configuration information for each field device.	Y						
2.4.2.2.1	The date that each intersection dataset was created should be maintained.	Y						
2.4.2.2.2	The date and time that each intersection dataset was downloaded should be maintained (for each download).	Y						
2.4.2.2.3	These archives shall be easily accessible, viewable, and printable in the same format that current data would use.	Y						
2.4.2.2.3.1	Archived file shall show the date and time at which the archive file was created (as opposed to the date on which it was displayed or printed) when viewed or printed.	Y						
2.4.2.3	The system shall have the capability of storing a text description documenting explanations of why changes were made to the programming of an intersection.	Y						
2.4.2.4	The system shall have a way of storing attachments related to the particular intersection such as photos, phasing layouts, and detector assignments.	Y						
2.4.2.5	All system parameters, to include the timing parameters for each individual intersection shall be able to be queried. For example, it shall be possible to identify all intersections in which a ped recall is currently applied in the timing parameters.	Y						
2.4.3	The system shall support the editing, copying and deleting of data.	Y						
2.4.3.1	Data-entry formats shall be designed for easy data preparation by the operators	Y						
2.4.3.2	All configuration information shall be printable in the proper format for use by the traffic engineers and maintenance technicians in the field	Y						

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2.4.3.3	System shall also provide a means to export configuration informations to spreadsheet programs in comma-separated variable format (csv) and as text files. All columns and rows shall be clearly labeled using terms consistent with those used in the central software, local controller software, documentation, and training materials.	Y						
2.4.3.4	In order to alleviate repetitive data entry, the system shall allow the operator to copy configuration information to multiple devices	Y						
2.4.3.5	System generation of traffic control operations shall include safeguards to preclude dangerous or undesirable intersection operation.	Y						
2.4.3.5.1	These safeguards shall, as a minimum, include range checking, and coordinated timing plan diagnostics for each pattern/split combination.	Y						
2.4.3.5.2	At a minimum, timing plan diagnostics shall check for the following:	Y						
2.4.3.5.2.1	Split times which violate minimum phase lengths (minimum green + yellow + all red)	Y						
2.4.3.5.2.2	Split times which violate pedestrian times (walk + flashing don't walk + yellow + all red)	Y						
2.4.3.5.2.3	Split times which do not add up to cycle length	Y						
2.4.3.5.2.4	Split times which cause barriers to not be aligned.	Y						
2.4.3.5.3	The diagnostics shall check for split time violations which occur during short way correction mode as well as those which occur during the programmed cycle length for a given coordination pattern.							KITS has this deployed for other controller types. Can be added to NextPhase. Currently not priced into phase 1
2.4.3.5.4	Checking for splits which violate pedestrian times shall not prevent the use of vehicular splits which are less than the pedestrian times	Y						
2.4.3.5.5	When errors occur, the results shall be displayed clearly and concisely with information sufficient for timely correction by the operator	Y						
2.4.4	Periodic download of field device configuration	Y						
2.4.4.1	The system shall perform periodic and operator scheduled download of all field field device configuration informaiton and compare such field databases with the central system, which shall be considered to be the master	Y						

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2.4.4.2	In the event that a change is made to controller settings through the keypad or by means of a portable computer, the controller should automatically download any and all changes to the central system.							KITS has this deployed for other controller types. Can be added to NextPhase. Currently not priced into phase 1
2.4.4.2.1	After downloading, this change will be logged and stored in the appropriate tables in the database.							KITS has this deployed for other controller types. Can be added to NextPhase. Currently not priced into phase 1
2.4.4.2.2	The system operator will be notified that a change is waiting to be verified to be stored in the permanent data file for the intersection.							KITS has this deployed for other controller types. Can be added to NextPhase. Currently not priced into phase 1
2.4.4.2.3	This download shall occur without operator intervention, and shall occur not more than thirty minutes after the last change was made.							KITS has this deployed for other controller types. Can be added to NextPhase. Currently not priced into phase 1
2.4.4.2.4	It shall be possible for this feature to be deactivated at the system operator's discretion.	Y						
2.4.4.3	Operator may also choose to download and compare databases manually, if desired.	Y						
2.4.4.4	When comparing field and central system parameters (whether initiated by the operator or automatically through a change in field), the software shall highlight the discrepancies between the two data sets. The operator shall have the option of saving the downloaded field configuration information or uploading the central configuration information, or any part thereof, to the field.	Y						
2.4.5	System shall support data archival at administrator-defined intervals	Y						
2.4.5.1	The system shall be capable of storing all data generated by all intersections for at least 7 days without degrading the functionality of the system.	Y						
2.4.5.2	The cleanout time should be configurable by individual table	Y						
2.4.6	When an operator opens a controller database that is in use, the central signal system software shall display a message explaining to the operator that the database is already open.	Y						
2.5	LOGS	Y						
2.5.1	The ATMS Traffic Signal System shall maintain logs of system events	Y						
2.5.1.1	System logs shall be accessible from any workstation	Y						
2.5.1.2	System Operators shall be capable of defining specific events and/or time periods for viewing or report generation.	Y						

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2.5.1.3	The ATMS Traffic Signal System shall include a Traffic System Log	Y						
2.5.1.3.1	The ATMS Traffic Signal System shall log traffic-related events (including phase changes, detector calls, coordination events, etc.)	Y						
2.5.1.4	Events shall be listed in chronological sequence.	Y						
2.5.1.5	Each message should be stored with the date, time, and location.	Y						
2.5.1.5.1	The date and time recorded for each event should be based on the date and time the event occurred as reported by the local controller and not the date and time that the message was received by the central system or written into the log.	Y						
2.5.1.6	The system administrator shall have the ability to export event log data in MS Excel format	Y						
2.5.1.7	Log retention interval shall be set by the system administrator	Y						
2.5.1.8	The ATMS Traffic Signal System shall log users who are currently logged into the system.	Y						
2.5.1.8.1	The ATMS Traffic Signal System shall log the users name and the time the user logs in and out the system.	Y						
2.5.1.8.2	The ATMS Traffic Signal System shall display a list of the operators that are currently logged onto the central signal system software to a user-defined set of operators.	Y						
2.6	REPORTING	Y						
2.6.1	The ATMS Traffic Signal System shall include standard reports	Y						
2.6.1.1	Standard reports shall be obtainable from a menu of report names	Y						
2.6.1.2	Standard reports shall be obtainable from any operator workstation	Y						
2.6.1.3	Standard reports shall be displayed on the workstation monitor	Y						
2.6.1.4	Standard reports shall be printable	Y						
2.6.1.5	Data from standard reports shall be able to be exported in a format that can be opened and read by Microsoft Excel.	Y						
2.6.1.6	It shall be possible to save any standard report to a file	Y						
2.6.1.7	Where applicable, the user shall be able to limit the report details to a the whole system, a particular zone, a particular area, or a particular intersection or device.	Y						
2.6.1.8	At minimum, the ATMS Traffic Signal System shall include the following standard reports	Y						
2.6.1.8.1	System Status	Y						
2.6.1.8.1.1	The System Status Report shall include possible status conditions	Y						

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2.6.1.8.1.1.1	<p>This display is an overview of the present condition of all devices in the traffic system including intersection controllers, detectors, communication channels, and other categories of devices. The conditions shall include all possible status conditions (e.g. on-line, failed, etc.) and modes (e.g. TOD/DOW, On Flash, etc.) as described in this specification.</p> <p>At the discretion of the operator, it may be displayed as a list, or displayed as a map with colors or symbols used to indicate the status of each device. Regardless of how this data is displayed, it should update continuously without operator intervention.</p>	Y						
2.6.1.8.2	Intersection Operation	Y						
2.6.1.8.2.1	The Intersection Operation Report shall present the real-time intersection operation	Y						
2.6.1.8.3	Communication Statistics	Y						
2.6.1.8.3.1	This display/report shows the communications throughput. The display shall include number of communication attempts, number of successes, number of failures, and percentage of successful communications per intersection, per channel, and per system	Y						
2.6.1.8.4	Detailed Detector Failure Status							
2.6.1.8.4.1	This display/report displays the failure information for all failed detectors. This information shall include as a minimum: detector location, reason for failure, and time of failure.							KITS supports. Can be added to NextPhase. Currently not priced into phase 1
2.6.1.8.5	System Detector MOE Reports							
2.6.1.8.5.1	Detector Summary information should include the following:							
2.6.1.8.5.1.1	Counts/Speed/Occupancies over time	Y						
2.6.1.8.5.1.2	Total counts	Y						
2.6.1.8.5.1.3	Counts per time division (5, 10, 15, etc. minute intervals)	Y						
2.6.1.8.5.1.4	Real-time acquisition	Y						
2.6.1.8.5.2	Historical MOE reports should include information related to the selected system detectors. Information on this report should include:							
2.6.1.8.5.2.1	Present volume versus historical volume;	Y						
2.6.1.8.5.2.2	Present occupancy versus historical occupancy;	Y						
2.6.1.8.5.2.3	Present speed versus historical speed; and	Y						
2.6.1.8.5.2.4	Present delay versus historical delay.	Y						

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2.6.2	The ATMS Traffic Signal System shall have the capability of generating custom reports using Crystal reports or other 3rd party COTS							
2.6.2.1	Custom reports shall be definable by any system operator	Y						
2.6.2.2	Custom reports shall be definable from any operator workstation	Y						
2.6.2.3	System Operators shall be able to define report format and content	Y						
2.6.2.4	Custom reports shall be printable to any network printer	Y						
2.6.2.5	Custom Reports shall be savable to the standard reports list	Y						
2.7	GUI	Y						
2.7.1	The ATMS Traffic Signal System shall provide an easy to use interface	Y						
2.7.2	The GUI shall provide access to monitoring and control options from a single point.	Y						
2.7.3	The GUI shall provide hot keys for commonly used functions	Y						
2.7.4	The GUI shall provide right-click menu options for links to commonly used functions	Y						
2.7.5	The GUI shall provide both visual and audio alarms	Y						
2.7.6	The Operator shall be able to open several windows at one time	Y						
2.7.7	The ATMS Traffic Signal System shall include an Object Library that contains dynamic icon objects that show different states to reflect the current system/intersection status.	Y						
2.7.7.1	Dynamic objects shall include the following objects as a minimum:	Y						
2.7.7.1.1	Traffic Signals	Y						
2.7.7.1.2	Links	Y						
2.7.7.2	The Dynamic objects shall be placed on the GUI using an integrated graphical editor. It should not be necessary to create additional files in an external application in order to place the dynamic objects.	Y						
2.7.7.2.1	Dynamic objects shall be directly linkable to system database	Y						
2.7.7.2.2	Dynamic objects shall be placed on the GUI without software programming or recompilation.	Y						
2.7.7.2.3	The storage of the definition of the dynamic objects should occur on the application server such that all clients connected to the server can see the objects in the same way.	Y						
2.7.8	The ATMS Traffic Signal System shall include graphical displays for displaying and accessing system information	Y						
2.7.8.1	All commands for manipulating the graphical displays shall be available directly from the Operator Workstation	Y						

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2.7.8.2	Multiple traffic condition views shall be supported simultaneously on the operator workstation	Y						
2.7.8.3	Operators shall and able to access system functions using the graphical display system	Y						
2.7.8.4	Common icons shall be used as much as possible for all display levels.	Y						
2.7.8.5	All colors shall be selectable by the operator.	Y						
2.7.8.6	The same colors and icons shall also be used in display/report screens.	Y						
2.7.8.7	A legend shall be available within the display window, defining the meaning of each icon and color.	Y						
2.7.9	The ATMS Traffic Signal System shall include graphic displays for the display of real-time system information	Y						
2.7.9.1	The Operator shall be able to display the real-time graphics on the workstation and/or system monitor	Y						
2.7.9.2	Real-time graphics displays shall be available at the system, area, section, and intersection levels	Y						
2.7.9.3	The ATMS Traffic Signal System shall support the City's ESRI GIS system map and provide a connection to an online mapping system such as OpenStreetMaps, Google Maps or Bing maps.	Y						
2.7.9.3.1	The System Map shall display dynamic objects that represent the ATMS field devices	Y						
2.7.9.3.2	Selection of any particular dynamic icon on the system map shall display a more detailed status window	Y						
2.7.9.3.3	The System Map shall provide interactive mechanisms for editing and modifying dynamic graphic screens that are linked to the system dynamic elements	Y						
2.7.9.3.4	The System Map shall allow system operators to select the following specific system status information for viewing	Y						
2.7.9.3.4.1	Communications Status	Y						
2.7.9.3.4.2	Main Street Green	Y						
2.7.9.3.4.3	Preemption Status	Y						
2.7.9.3.4.4	Link Volumes	Y						
2.7.9.3.4.5	Coordination Status	Y						
2.7.9.3.4.6	Signals on Flash	Y						
2.7.9.3.4.7	Link Speeds	Y						

Exhibit 7
ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.7.9.3.5	The System Operator shall have zoom and scrolling capabilities within the System Map	Y						
2.7.9.3.6	The System Map shall be able to include the following minimal information:							
2.7.9.3.6.1	Major Streets	Y						
2.7.9.3.6.2	Street Names	Y						
2.7.9.3.6.3	Freeways	Y						
2.7.9.3.6.4	Rail Lines	Y						
2.7.9.3.6.5	Major Landmarks	Y						
2.7.9.3.6.6	Traffic Signal Controllers	Y						
2.7.9.3.6.7	CCTV Cameras	Y						
2.7.9.3.6.8	Dynamic Message Signs	Y						
2.7.10	The ATMS Traffic Signal System shall support aerial photography for use as the main map as well as the intersection graphics	Y						
2.7.11	The ATMS Traffic Signal System shall be capable of defining area maps which cover a specific area of the City	Y						
2.7.11.1	The ATMS Traffic Signal System shall support an unlimited number of Area Maps	Y						
2.7.11.2	The Area Maps shall include all the information and features of the System Map, plus the following information	Y						
2.7.11.2.1	Minor Streets	Y						
2.7.11.2.2	Individual Signal Phase Status	Y						
2.7.11.3	Information displayed on the Area Map shall be definable by the Operator	Y						
2.7.12	The ATMS Traffic Signal System shall provide individual intersection displays	Y						
2.7.12.1	Intersection Displays shall be accessed from a drop-down list or by double clicking on the intersection icon on the System or Area map at any zoom level or by zooming all the way in to the intersection.	Y						
2.7.12.2	Multiple intersection display windows shall be displayable simultaneously	Y						
2.7.12.3	The Operator shall be able to minimize and maximize the detailed intersection display	Y						
2.7.12.4	The Intersection Display shall be capable of including the following information (at minimum)	Y						
2.7.12.4.1	Street Names	Y						
2.7.12.4.2	Current Timing Plan in Use	Y						
2.7.12.4.3	Vehicle and pedestrian Displays	Y						

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ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.7.12.4.4	Overlap displays (different states of the flashing yellow arrow display should be clearly identifiable.)	Y						
2.7.12.4.5	Current Communication Status	Y						
2.7.12.4.6	Control Mode	Y						
2.7.12.4.7	Vehicle calls per phase	Y						
2.7.12.4.8	Pedestrian calls per phase	Y						
2.7.12.4.9	System detector actuation	Y						
2.7.12.4.10	Special functions	Y						
2.7.12.4.11	Detector actuations (inputs)	Y						
2.7.12.4.12	Local and Master Cycle Timers, if used	Y						
2.7.12.4.12.1	Cycle Counters shall count up to a value equal to the length of the current cycle	Y						
2.7.12.4.13	Preempt status	Y						
2.7.12.4.14	Priority status	Y						
2.7.12.4.15	Overlap Information	Y						
2.7.12.4.16	Lane control state	Y						KITS is deployed with reversible lane functionality in Miami-Dade County. This can be added for NextPhase graphics. This operation is priced into phase 1
2.7.12.5	The ATMS Traffic Signal System shall indicate the interval that each active phase is currently in							Additional investigation required to determine if possible with NextPhase
2.7.12.5.1	The amount of time that the phase has been in the current interval shall be displayed using a counter that counts upward.	Y						
2.7.12.6	The ATMS Traffic Signal System shall provide an upward incrementing counter for the entire split time for each phase when running in coordinated mode.	Y						
2.7.13	The ATMS Traffic Signal System shall refresh information of the graphics displays as frequently as the data is being returned from the field devices.	Y						
2.7.14	Specific intersections can be located using a search tool	Y						
2.7.14.1	The search tool shall allow the use intersection numeric identification number or street name as the search entity.	Y						
2.7.14.2	The user shall be able to search for intersections within a particular grouping	Y						
2.8	DETECTORS	Y						
2.8.1	The ATMS Traffic Signal System shall support system and local detectors	Y						

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ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.8.2	The Detectors shall be capable of being used for vehicle detection, traffic counting, traffic flow monitoring, and traffic-responsive operation.	Y						
2.8.3	The ATMS Traffic Signal System shall process and maintain detector count and occupancy data on a continuous basis.	Y						
2.8.4	The ATMS Traffic Signal System shall support the following types of detector data types:	Y						
2.8.4.1	Volume	Y						
2.8.4.2	Occupancy	Y						
2.8.4.3	Travel time	Y						
2.8.4.4	Arrivals on Red/Green	Y						
2.8.5	The ATMS Traffic Signal System shall be capable of automatically logging detector data in the database	Y						
2.8.6	The System Operator shall be able to enable/disable the recording of detector data	Y						
2.8.7	The Detector data shall be archived periodically	Y						
2.8.8	The parameters for management and storage of the detector data shall be configurable by the System Operator	Y						
2.8.9	The ATMS Traffic Signal System shall continuously monitor detector data from the field for proper operation	Y						
2.8.9.1	Detectors shall be classified as acceptable, marginal, disabled, and failed.							Classification are currently different but can be modified. This is not priced into phase 1
2.8.9.2	Detector failures shall be reported to the system log and operator alarm.	Y						
2.8.9.3	The software shall have operator-selectable filters that define the thresholds that a detector must exceed to be considered failed.	Y						
2.8.9.3.1	The filter values shall be selectable on a TOD basis	Y						
2.8.9.4	As a minimum, the following four failure types shall be diagnosed:	Y						
2.8.9.4.1	Maximum Presence	Y						
2.8.9.4.1.1	if an active detector exhibits continuous detection for a program entered period (0-255 minutes in one minute increments)	Y						
2.8.9.4.2	No Activity	Y						
2.8.9.4.2.1	if an active detector does not exhibit an actuation during a program period (0-255 minutes in one minute increments)	Y						
2.8.9.4.3	Erratic Output	Y						

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No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.8.9.4.3.1	if an active detector exhibits excessive actuation (program entered maximum counts per minute 0-255 in increments of one)	Y						
2.8.9.4.4	Failed Communication	Y						
2.8.9.4.4.1	failed detectors shall not be available for traffic control strategies	Y						
2.9	TIME	Y						
2.9.1	The system shall use NTP to synchronize all controllers, workstations, and central system time	Y						
2.9.2	The ATMS Traffic Signal System shall transmit a clock update in conjunction with the command for the implementation of a different timing plan	Y						
2.9.3	The software should also upload, on a periodic basis selectable by the operator, the date/time from local controller and other field clock. If the controller time has drifted beyond an operator-defined amount, then:	Y						
2.9.3.1	the system shall automatically download the true time to the controller	Y						
2.9.3.2	the system should report the clock drift to the operator	Y						
2.9.3.3	the event and action is logged	Y						
2.9.4	The software must have the ability to enable or disable daylight savings functions, handle leap years, and holidays and special events. All software must be capable of operating in the central time zone.	Y						
2.10	SETUP	Y						
2.10.1	The ATMS Traffic Signal System shall be capable of assigning field devices to control groups.	Y						
2.10.2	Field devices shall be assignable to more than one of the control groups	Y						
2.10.3	The ATMS Traffic Signal System shall support a minimum of 500 control groups	Y						
2.10.4	The ATMS Traffic Signal System shall be capable of transmitting any command to all devices within a control group.	Y						
2.11	TSD	Y						
2.11.1	The ATMS Traffic Signal System shall provide static and dynamic green band displays.	Y						
2.11.2	System Operators shall be able to select real-time or timings stored in the database for the green band display	Y						
2.11.3	System Operators shall be able to select the intersection to be displayed searching by asset number or name or by selecting a control group.	Y						

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ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.11.4	The time-space diagram shall be capable of overlaying GPS coordinates from a travel time run over a plot of the signal timings that occurred during the same time period as the travel time run.	Y						
2.11.5	The time-space diagram shall provide information as to the cause of phase termination when viewing historical timings (i.e. when the mouse hovers over a termination point.)			Y				Similar functionality exists. Will be developed to support this as part of this initial phase
2.11.6	The operator shall then be able to perform on-screen fine-tuning, using click and drag methods to adjust the offsets, with the resulting changes in the widths of the progression bands being displayed. The operator shall then be able to save to the database the resulting changes in offsets for that timing plan	Y						
2.12	COMMUNICATIONS	Y						
2.12.1	The ATMS Traffic Signal System shall manage all communications between the system servers and the field devices.	Y						
2.12.2	The ATMS Traffic Signal System shall provide a message communications scheme that ranks messages to field devices on a priority level basis.	Y						
2.12.3	User-initiated messages shall have higher priority over polling messages	Y						
2.12.4	The Communications scheme shall allow dropping of real-time monitoring to help facilitate the quickest completion of higher priority messages	Y						
2.12.5	The ATMS Traffic Signal System shall also prioritize communications to field devices based on the present use of the system	Y						
2.12.6	The system administrator shall have the ability to configure the polling timeout in milliseconds for each device.	Y						
2.12.7	The Communications type shall be selectable by the System Operator	Y						
2.12.8	The ATMS Traffic Signal System shall monitor communications between the system servers and field devices	Y						
2.12.8.1	The ATMS Traffic Signal System shall fail individual components when operator-selectable thresholds are exceeded	Y						
2.12.8.2	If communications fails, the ATMS Traffic Signal System shall display a heads-up alarm to the system operator	Y						
2.12.8.2.1	The ATMS Traffic Signal System shall log all communication failures	Y						
2.12.8.2.2	The ATMS Traffic Signal System shall continue to attempt to reestablish communications with the failed component for an operator-definable amount of time.	Y						

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ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.12.8.2.3	If communications is re-established within the selected time period, the component shall be considered operational	Y						
2.12.8.2.4	If communications is re-established, the ATMS Traffic Signal System shall log the event and clear the alarm	Y						
2.12.8.2.4.1	The System Operator shall be able to enable/disable communications monitoring through the GUI.	Y						
2.12.9	The ATMS Traffic Signal System shall be capable of monitoring communications performance.	Y						
2.12.9.1	The ATMS Traffic Signal System shall provide statistics on communication downtime and number of drops on a group, intersection, and system-wide basis over a user selectable time period.	Y						
2.13	POLLING							
2.13.1	The ATMS Traffic Signal System shall be capable of providing once per second polling of all field devices	Y						
2.13.2	Polling rates shall be selectable by the System Operator on a channel by channel or individual intersection basis.	Y						
2.13.3	When viewing multiple intersections, the ATMS Traffic Signal System shall be capable of automatically varying polling rates to insure once-per second refresh rates.	Y						
2.14	REMOTE ACCESS	Y						
2.14.1	The ATMS Traffic Signal System shall provide a means for allowing a direct connection to program and read data from the local intersection controllers	Y						All KITS services, and integrated laptop KITS UI can be configured on up to 10 laptop computers. City is responsible for procuring hardware and software licenses.
2.14.1.1	Direct connection methods should not require a connection to the server to function properly.	Y						
2.14.1.2	Though other devices can be supported for the direct connection methods, at a minimum these methods must support laptop computers.	Y						
2.14.1.3	Devices connected directly to the local intersection controllers shall be able to upload/download timing parameters and set time and date on the controller	Y						
2.14.1.4	Devices connected directly to the local intersection controllers shall synchronize their database with the Central database upon next connection to the LAN.	Y						
2.15	SPLIT MONITORING							
2.15.1	The ATMS Traffic Signal System shall be capable of comparing programmed phase timing to real-time phase returns	Y						

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No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.15.1.1	The comparison of programmed and real-time phase data shall be displayed on the operator workstation.	Y						
2.15.2	The ATMS Traffic Signal System shall be capable of monitoring actual split times by phase.	Y						
2.15.2.1	Intersections or control groups for which the splits will be recorded shall be user selectable	Y						
2.15.2.2	Splits shall be displayed as a summary over a specified time period or on a cycle by cycle basis	Y						
2.15.2.3	Splits shall be accurate regardless of the programmed ring and barrier structure that is in use and should be displayed for all phases in use.	Y						
2.15.2.4	Splits shall be displayed for all cycles during the requested time period regardless of plan change or whether the signal is running in coordinated or free mode.	Y						
2.15.3	The ATMS Traffic Signal System shall display the percentage of time that the phase was terminated because it reaches it maximum value	Y						
2.15.4	The ATMS Traffic Signal System shall display the percentage of time that the phase was terminated because it was forced off	Y						
2.15.5	The ATMS Traffic Signal System shall display the percentage of time that the phase was terminated because it gapped out	Y						
2.15.6	The ATMS Traffic Signal System shall have the ability to export the split monitor report to an Excel compatible file.	Y						
2.16	EXPORT							
2.16.1	The ATMS Traffic Signal System shall provide a means of uploading and downloading timing information for data analysis and timing development	Y						
2.16.1.1	The ATMS Traffic Signal System shall be capable of importing and exporting traffic volume data	Y						
2.16.1.2	The importing and exporting of data in the Universal Traffic Data Format (UTDF) shall be supported							Dependent on controller/firmware. Not part of existing NextPhase functionality or priced into phase 1 of this project. Can be added for additional fee
2.17	CENTER TO CENTER							
2.17.1	The ATMS Traffic Signal System shall be capable of sending and receiving information from transportation partners using the current Center-to-Center protocol implemented by the Texas Department of Transportation.	Y						

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No.	Requirement	out of box	with configuration	requires customization	3rd party (if Yes, list firm's name and role)	future release	not available	Solution Description (30 words or less)
2.17.1.1	The data to be exchanged should include at a minimum traffic signal plan selection, link speed data, link travel time data, incident locations, and camera snapshots.		Y					Base functionality will be provided. Additional services required for KHA, TCI, ITSD TxDOT IT collaboration modify network to securely exchange data
2.18	TRANSIT SIGNAL PRIORITY							
2.18.1	The ATMS Traffic Signal System must be able to receive a transit signal priority (TSP) request message via a communications socket from the VIA Metropolitan Transit Authority servers and correctly act on the message to apply a check in or check out detector call at the appropriate signalized intersection.			Y				Special functions will be used since remote detector call are not supported in NextPhase 1.7.7 with NTCIP. Software development will be required and is included in base price
2.18.2	It shall be possible to define transit detection zones within the system software such that when a TSP message is received, the appropriate detector on the appropriate approach and direction and for the specified bus route is triggered		Y					
2.18.3	The message received from the VIA servers will be an XML message in the form shown in Exhibit 6.		Y					
2.18.4	The system software shall be capable of generating logs and reports that show the number of TSP requests that have been received per intersection and per detector.		Y					
2.18.4.1	The reports should also provide metrics indicating the impact that the TSP request had on the intersection operations (i.e. was priority granted, and if so was a phase extended or terminated early to accommodate the priority request).	Y						
2.19	TRAFFIC RESPONSIVE CONTROL							
2.19.1	The ATMS Traffic Signal System shall be capable of operating in traffic responsive mode as described below.	Y						Substantial integration required for TRSP. KHA will provide all functionality, the City will need to determine and configure volume and occupancy detector signatures for each timing plan
2.19.1.1	The ATMS Traffic Signal System shall select the timing plan that is best suited to the existing traffic conditions as measured by the system detectors and analyzed by the central system's traffic-responsive process	Y						
2.19.1.2	Volumes and occupancies of system detectors assigned to inbound, outbound, and side street traffic are scaled and monitored by the algorithm	Y						

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ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

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2.19.1.3	Once the traffic-responsive algorithm has selected the appropriate timing plan, the plan number shall be commanded to the intersections on a continuous basis until the traffic-responsive process recognizes, based on sufficient change in traffic conditions, the need to command a different timing plan.	Y						
2.19.1.4	All of the algorithms' plan changes are to be logged	Y						
2.19.1.5	Should communications be lost to one or more intersections in a section operating in Traffic-Responsive mode, for an operator-defined time frame, the whole section will drop back to its local TOD/DOW schedule	Y						
2.20	ADDITIONAL FUNCTIONS	Y						
2.20.1	Support for Dynamic Message Signs. This would include a communications interface using the NTCIP protocol, and a message management system	Y						
2.20.2	Support for Closed Circuit Television Cameras (CCTV); this additional functionality would include the camera control system.	Y						
2.20.2.1	The control system would include pan, zoon, tilt, iris, pre-sets.	Y						
2.20.2.2	The camera protocol will include Cohu, but others may be considered.	Y						
2.20.3	Historical Controller Database Configuration Management Tool. This functionality is the ability for the City to store notes with different timing plans. The user should have the ability to store historical controller databases over time as individual files.	Y						
2.20.4	Alert Prioritization. This functionality provides the ability to define specific users as priority recipients with secondary users being alerted if only the top priority user did not respond within some user-programmable time period.	Y						
2.20.5	Real-time I/O display. This functionality would provide the ability for the user to view an intersection graphic that would show dynamic icons representing the Inputs and Outputs of the controller.	Y						
2.20.6	External Call placement. This functionality would allow the system operator to place vehicle, pedestrian, and preemption calls to a controller using the Central System Software. The controller firmware/software will be required to support external placement of calls.	Y						NextPhase version 1.7.7 does not appear to support this functionality over NTCIP. This can be achieved by mapping a special function to a detector. KITS is able to send an NTCIP command to implement a special function
2.20.7	TxDOT Center-to-Center Support. This functionality is supporting the current TxDOT Center-to-Center standard for sharing data between centers.	Y						

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ATMS Functional REQUIREMENTS TRACEABILITY MATRIX

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x

NextPhase does not do this.

NextPhase will skip movements on occasion when chanign config tables.

