ITEM 856.3 REAL-TIME TRAFFIC MANAGEMENT SYSTEM FOR WORK ZONES LUMP SUM

General Description

This work consists of furnishing, installing, relocating, operating, maintaining and removing an automated, portable, real-time traffic management (RTTM) system for work zones for duration of the project.

The RTTM system shall consist at a minimum of the following:

- sensors to monitor and record traffic data as stipulated herein,
- portable changeable message signs (PCMS) to display real-time messaging to the general public and
- Pan/Tilt/Zoom capable closed circuit television cameras (CCTV) to view roadway and construction areas.

Included in the operational responsibilities is the assumption of all communication and power costs such as FCC licensing, cellular telephone, wireless data networks, satellite and Internet subscription charges, solar system support and battery charging and maintenance. In addition to these requirements, the Contractor shall assume all responsibility for any damaged RTTM equipment due to crashes, vandalism, adverse weather, etc. that may occur during the systems deployment.

The goal of this system is to monitor and collect traffic data along various roadways within this projects impact area and disseminate real-time traffic condition information based on the data collected to the Massachusetts Department of Transportation (MassDOT) and the traveling public via field installed PCMS and a Contractor supplied and maintained website. It is anticipated that traffic conditions will deteriorate due to queuing caused by high traffic volumes, work zone vehicle interference, weather, grade changes, etc. This project will require the vendor to supply the necessary equipment to monitor traffic, collect data and provide real-time reporting due to these conditions. The Contractor shall furnish this RTTM system for measuring and delivering traffic condition-responsive messages for this Project's impact area.

RTTM Timeline Requirements And Submissions

At least 60 days prior to beginning installation, contractor shall submit to MassDOT for review and approval evidence that the Contractor or Subcontractor has successfully completed at least five (5) RTTM projects similar in concept and scope to the proposed system. Include names, addresses and telephone numbers of the owner's representatives for verification. The Contractor shall also submit all brochures and cut sheets on all the equipment to be used as part of the RTTM system, with details of how and which communications systems shall be used, and implementation of the Website systems. The Contractor shall also propose the actual device layout to MassDOT for approval.

All of the required components of the RTTM system as specified herein shall be installed and fully operational 21 days prior to the closure of the Callahan Tunnel.

The system shall be free of malfunctions for a minimum of 7 days prior to final acceptance for use on the project.

Vendor/Manufacturer Equipment Demonstration

Prior to acceptance of the RTTM system for deployment and prior to installation in the field MassDOT reserves the right to require a local demonstration under actual working conditions, of equipment bid under this item. The demonstration would be performed (free of charge) by the Vendor/Manufacturer at a mutually acceptable location. The Vendor/Manufacturer is to coordinate with MassDOT as to the exact location and time of the demonstration. It is the responsibility of the Vendor/Manufacturer to provide manuals, notes, and other materials for up to ten attendees at the demonstration. The Vendor/Manufacturer is responsible for providing programming and setting up all equipment necessary for the demonstration. If requested, the Vendor/Manufacturer should be prepared to demonstrate the equipment within 30 days after notification. MassDOT will reject any equipment which, in MassDOT's judgment, does not adequately provide a RTTM system as called for on under these items.

System Requirements

The RTTM system shall provide the following:

a. Monitor and collect traffic data along various roadways within this projects impact area and disseminate real-time traffic condition information based on the data collected to the Massachusetts Department of Transportation (MassDOT) and the traveling public via field installed PCMS and a Contractor supplied and maintained website via the internet. The website may be accessed via a web portal or utilizing client side system software. Should software installation be required for access, the Contractor shall install, configure and troubleshoot the software required on any MassDOT computer as necessary to access the full functionality of the website.

b. The RTTM system software shall be configured so that appropriate personnel at MassDOT are notified by email in text format each time a malfunction has occurred in the system and a malfunction record is made in the database. Configure the software so that any number of approved personnel can be notified in this manner. The notification shall also display an error message for the device or devices affected. Please note that the RTTM system Webpage Integrator is responsible for this notification procedure. The RTTM system shall provide device outage alerts via email to MassDOT for outages greater than 30 minutes. The email addresses for recipients of these outage alerts will be provided by MassDOT. Any pay reductions as per the pro-rated schedule (see Section "Operational Performance") will be calculated from these outage summaries.

c. The RTTM system shall be capable of providing current operational and location status (i.e. current traffic data and messages, communications system, signs and sensors as well as lat/long of all deployed devices) via the Internet to a dedicated contractor developed and maintained website established for the purpose of monitoring the corridor and the RTTM equipment.

d. The RTTM system shall be configured to assess any type of malfunction that has occurred. This assessment includes communications disruption between any device in the system configuration, changeable message board malfunctioning, CCTV Camera

malfunction, speed sensor malfunction, loss of power, low battery, etc. This malfunction information shall be sent via email in text format to MassDOT for each occurrence.

e. To support incident management, the RTTM system shall be configured to allow project personnel to manually override motorist information messages for a user-specified duration, after which automatic operation will resume with display of messages appropriate to the prevailing traffic conditions. Any overriding message needs to have the message content and the username logged into the database.

f. The RTTM system shall be capable of calculating and having "real time" delay or travel time information displayed on the PCMS'. This "real time" information shall be calculated and displayed on the PCMS' to the nearest minute along with the current time of day.

g. This project will also require the RTTM system to have the capability to notify MassDOT personnel (by email and text) once the speed through the work zone decreases below 15 MPH. This speed threshold shall be able to be changed throughout the project. The RTTM system will be capable of transferring (each minute at a minimum) a snapshot of the real time data to an external website that is provided by and maintained by the Contractor. The RTTM system shall allow for any number of MassDOT employees to be notified via e-mail of these speed changes.

h. If so requested, the Contractor shall add additional MassDOT supplied PCMS and CCTVs to the RTTM system. MassDOT will provide all communications information necessary to the contractor to add the additional PCMS to the RTTM System.

i. To allow for motorist information messages of high specificity, the RTTM system shall acquire quantitative traffic data of accurate speed measurement that includes the capability of detecting stopped traffic and counting traffic volume.

RTTM System Website

At a minimum the RTTM system Website shall have the following:

a. The Website shall be configured to provide a password protected link for approved personnel to have access to the operational characteristics of the system to manually override messages on the RTTM PCMS'.

b. Each RTTM device shall have a unique device identifier. These identifiers shall be coordinated with and approved by MassDOT at the beginning of the project and shall not change unless approved by MassDOT.

c. The Website shall be configured to display current traffic conditions and real time speed at all locations to the nearest minute. The "real time" delay information displayed on the PCMS' is updated every 1 minute minimum and the website delay information is updated simultaneously with the delay information displayed on the PCMS'.

d. The website shall be configured to support the scheduling of messages by the operator. Such scheduling shall allow the operator to set a message on a sign or group of signs to turn on and to turn off at times set in the future.

e. Via the internet and the dedicated website, the website shall provide a full color map using Google Maps or equivalent depicting the project area with locations of portable traffic sensors, PCMS, and CCTV Cameras. Using the defined color-coding scheme (specified herein), the map reflects the current average speed at each portable traffic sensor and displays the entire information message being shown by each PCMS either on the map or on another part of the websites main page. The map should be automatically refreshed a minimum of once every minute to display any changes to portable traffic sensor(s) and/or PCMS's. The website shall also allow for access to, control of and viewing of the CCTV Cameras via the same webpage.

f. The Website delay information is to be updated simultaneously with the traffic speed information displayed on the Portable Changeable Message Signs. The Website shall be capable of displaying traffic speeds using green above 35 mph, yellow 34 –16 mph, and red below 15 mph.

g. Provide access to historical and real-time traffic data recorded by the RTTM as part of the project for a period of 6 months following acceptance of the data provided by the Contractor to MassDOT.

h. Access to RTTM website shall be via an external website portal or remote client software access.

Equipment Requirements

The RTTM system shall consist of the following equipment as a minimum:

a. Portable Traffic Sensors (PTS)

b. Portable Changeable Message Signs (PCMS)

c. Mobile Video CCTV Cameras (CCTV)

d. Communication equipment for all above pieces including wireless data networks, base stations, cell phone data interfaces, Ethernet network interfaces and internet interfaces.

e. Customized Webpage integrated with the RTTM System such that all RTTM devices may be monitored or modified via the RTTM Website by MassDOT.

f. Software package customized for this particular project's needs or equivalent.

In addition to the above specified equipment, the following shall be provided for each RTTM PTS, PCMS & CCTV:

a. Each shall be individually mounted units with solar, battery or continuous power sources (non-motorized).

b. Each shall be equipped with digital modems or wireless data interfaces as required.

c. Each shall be capable of being linked back to the RTTM Website and accessible to MassDOT.

d. Each device shall have all components secured with locked compartments to prevent unauthorized access.

e. Local operation of each device shall be password protected to restrict unauthorized access. MassDOT shall be provided with a list of passwords for each device prior to the conclusion of the operational test period.

f. Each device shall be installed such that it cannot be removed or relocated by unauthorized personnel.

Traffic Sensors

a. The PTS shall be of a type whose accuracy is not degraded by inclement weather of degraded visibility conditions including precipitation, fog, darkness, excessive dust, and road debris.

b. The PTS shall be capable of acquiring traffic data for up to six lanes of traffic in multiple directions.

c. Each PTS sensor shall communicate with the RTTM System as well as the RTTM website to modify the appropriate PCMS messages depending on the prevailing traffic speed.

d. The PTS shall be capable of being installed along the roadway at a manufacturer recommended height and angle such that recording traffic data on each lane is not occluded by any of the adjacent travel lanes.

Portable Changeable Message Signs (PCMS)

The following messaging requirements are to be met:

a. The signs shall be trailer mounted. The message panel shall be at least 7 feet above the pavement, present a level appearance, and be capable of displaying up to eight characters in each of three lines at a time. Character height shall be 18 inches. The pixel matrix shall be a 5 wide by 7 high or of similar proportions. The sign panel shall be an LED type Full-Matrix sign.

b. The message panel shall be capable of being visible from ¼ mile under both day and night conditions. The letters shall be legible from 800 feet.

c. The sign shall include automatic dimming for night-time operations.

d. The message sign shall provide for remote sign operation via RTTM Website allowing operators to manually override the automated messaging in order to display a message at

any time. The operator shall be able to cancel this override and initiate the systems automated messaging feature. Each message sign shall be capable of manual local operation via a hard-wired keyboard control.

e. All messages are to be center-justified.

f. Messages to be displayed shall have the capability to be modified autonomously at various times of the day and days of the week.

g. Any request to change the messages on the Portable Changeable Message Signs shall be approved by MassDOT.

h. The message board shall have a visible solar charge current meter and the battery charger current meter.

i. The message board shall utilize a hydraulic lift to raise and lower the sign panel to display height.

j. Solar panel array shall be sized to replace the power used in typical daily operation with less than four hours of sun.

k. The battery bank shall have adequate amp-hr capacity to operate the message board continuously in the absence solar recharge for a minimum of 30 days.

CCTV Cameras

The RTTM system shall be configured with the following camera requirements as a minimum:

Table 1: CCTV Specification

No.	FEATURE	SPECIFICATION
1.	Zoom Ratio	The zoom ratio shall be 35x Optical and 12x Digital Minimum
2.	Auto Focus	The camera shall have an auto focus with manual override capability.
3.	Zoom Speeds	The camera shall support variable zoom speeds. Typical wide to telephoto: 3.2/4.6/6.6 seconds.
4.	On-Screen Direction and Zoom Indicator	The CCTV camera shall display on-screen azimuth and elevation position indications in degrees and optical and digital zoom levels.
5.	CCTV Camera Zones and Programming by Contractor	The CCTV camera shall display up to ten zones, each with a unique 20-character title. The Contractor shall program CCTV camera with up to ten zones, including at a minimum: North, South, East, and West directional zones.
6.	Privacy Zones	The CCTV camera shall be programmable to blank out up to eight (8), four-sided areas to electronically block portions of the camera's field of view from being displayed. These privacy zones shall move and adjust sizing synchronously with camera movements and degree of lens zooming.

7.	On-Screen Labels, Text and Titles	The CCTV camera shall display a minimum of 20 programmable characters for on-screen camera ID, preset position, sector, and alarm titles.
8.	On-Screen Labels, Text and Title Positioning	The position of the on-screen text shall be adjustable to appear at selectable positions on the CCTV camera screen image.
9.	Variable Speed Tilt	The camera Pan Tilt (PT) unit shall provide a variable speed tilt speed range of up to 40° per second at the highest rate.
10.	Variable Speed Pan	The camera PT unit shall provide a variable speed pan speed range of up to 150° per second at the highest rate.
11.	Proportional Pan/Tilt Speed	The camera PT unit shall provide a proportional speed Pan/Tilt capability, where the speed decreases automatically as the zoom level increases.
12.	Pan Range	The camera PT unit shall provide a 360° continuous pan rotation without cable interference or tangling.
13.	Tilt Range	The camera PT unit shall provide a +2° to -92° tilt range from horizontal.
14.	Auto-Flip Camera Orientation	The CCTV camera assembly shall include an auto-flip function to automatically reposition the camera 180-degrees for uninterrupted viewing, in the correct orientation, as the camera moves to view objects beneath the dome.
15.	Number of Presets and Performance	The camera/receiver shall support a minimum of 79 presets. The movement to the preset shall occur within one second (maximum) and with 0.1 degrees accuracy.
16.	Preset Labels	The CCTV camera shall include titles for each preset with a minimum of 20 characters per preset title.
17.	Number of Pixels	The camera shall provide a minimum of 750H x 480V pixels.
18.	NTSC Resolution	The camera shall support a minimum of 540 TV Lines, NTSC horizontal resolution.
19.	Image Sensor Size	The camera shall include an image sensor of ¼ inch.
20.	Lens Focal Length	The camera shall include a zoom lens of 3.4 mm to 119 mm minimum focal length.
21.	Color and Black & White Image Selection	The camera shall have Color and Black & White video image display modes with both automatic and manual selection. The camera shall transition automatically to a Black & White mode (when in automatic mode) when the luminance reaches a predefined threshold (used during evening hours or periods of low luminance).
22.	Color and Black & White Image Selection and Video Frame Rate	The CCTV camera image display shall vary between day and night by reverting to quasi-monochrome operation at night for increased sensitivity. At all times the camera shall provide a full motion video output at 30 frames per second. Long-term image integration is not acceptable.
23.	Image Stabilization	The CCTV camera shall incorporate electronic image stabilization to reduce the effects of vibration and wind gusts on the displayed video image.

24.	Video Output Signal	The camera shall provide an NTSC video output and be compliant with the NTSC video standard.
25.	Automatic Iris	The camera shall include both automatic iris control and an override for manual iris adjustments.
26.	Video Signal to Noise Ratio	The CCTV camera video signal to noise ratio shall be > 50 dB
27.	Wide Dynamic Range	The CCTV camera wide dynamic range shall be greater than or equal to 128X.
28.	CCTV Camera Optical Sensitivity	The sensitivity required to provide an output video signal level of 35 IRE shall be less than or equal to 0.55 lux at a shutter speed of 1/60 second.
29.	Dome Housing	The camera dome housing shall be provided by the camera manufacturer as an integrated product. See Table 2, Dome Specifications.
30.	CCTV Camera and Dome Mounting	The CCTV camera and dome assembly shall be fully compatible mechanically and electronically with the CCTV trailer.
31.	Power Input	The power input requirements for the CCTV camera and dome shall be 18 to 32 VAC, 24 VAC nominal; or 22 to 27 VDC, 24 VDC nominal; selectable.
32.	External Operating Temperature Range	See Dome Specifications in Table 2.
33.	Surges	The camera and dome assembly shall sustain normal operations when subject to transient voltages, surges, and sags normally experienced on commercial power lines and continue operation during AC main input line voltage variations of between 95 volts and 135 volts AC.

Table 2: Dome and Camera Equipment Specification

No.	FEATURE	SPECIFICATION
1.	External Operating Temperature Range	Unless otherwise specified, the equipment inside the dome shall remain functional with outside temperatures ranging from -40° C to 50° C (-40° F to 122° F).
2.	Humidity	Unless otherwise specified, the equipment inside the dome shall remain functional with an outside relative humidity from 0-100%.
3.	Pressurization	The dome shall have a Pressure Release Valve for safety, and be pressurized.
4.	Outer Dome Cover	The outer dome shall be constructed of rust-free components.
5.	Sunshield	The dome shall have a UV light resistant outer sunshield.

6.	Lower Dome Cover	The lower dome cover shall be distortion free, cell-cast acrylic plastic or free blown, UV Coated, with no fastening holes (to avoid cracking).
7.	Environmental and Corrosion Resistant Requirements	The CCTV camera dome assembly shall be rated NEMA 4X.
8.	Surge Protection	There shall be surge protection within the dome enclosure for the video and power. This surge protection is in addition to the surge protection specified for use in the equipment cabinet.

The RTTM system shall be configured with the following video requirements:

a. The video from the cameras shall be provided in a format capable of being displayed at the MassDOT HOC and the project web page at a rate of at least 1 frame per second.

b. The web page provided shall allow at least 100 users to access the video on the web page without having the frame rate drop to less than 1 frame per second.

c. The video must be viewable through the RTTM web page.

d. The video format must be of such type as to allow the video to be posted at the MassDOT HOC.

Operational Requirements

System Communications - The Contractor shall ensure that the RTTM system communications meet the following requirements:

a. The Contractor performs the required configuration of the RTTM's communications system during system initialization.

b. Communications between the server and any individual PCMS, CCTV and PTS are independent through the full range of deployed locations and do not rely upon communications with any other PCMS, CCTV or PTS.

c. The RTTM's communications system incorporates an error detection/correction mechanism to insure the integrity of all traffic conditions data and motorist information messages.

In addition to meeting manufacturer's specifications, the Contractor shall program the RTTM system to ensure that the following General Operational requirements are met:

a. The RTTM system portable traffic sensors (PTS) shall be such that the accuracy is not degraded by inclement weather and visibility conditions including precipitation, fog, darkness, excessive dust and road debris. These sensors shall be capable of acquiring traffic data for up to 6 lanes of traffic on a lane-by-lane basis. The data acquired shall

provide traffic volume, individual vehicle speed, and lane occupancy on a lane by lane basis at a minimum.

b. The RTTM system shall operate continuously (24 hours, 7 days a week) when deployed on the project. It shall always be collecting and storing data.

c. All traffic data & motorist information messages displayed by the RTTM system shall be archived into the database with time and date stamps.

d. The RTTM system shall be capable of acquiring the aforementioned data, developing travel times, and selecting motorist information messages automatically without operator intervention after system initialization.

e. The RTTM system shall be capable of automatically selecting default and advisory messages based on traffic conditions at a single traffic sensor point or at multiple traffic sensor points in combination.

f. MassDOT users have the capacity to create and save a library of messages with up to 20 different default or automatic advisory messages for each PCMS. The Contractor shall preprogram a set of messages based on guidance contained herein for each PCMS as a starting point for further refinement in coordination with MassDOT. The Contractor shall establish all PCMS messaging to be used on the project in the library at the direction of MassDOT.

g. All RTTM system operator control functions shall be password protected.

h. To support incident management, the RTTM system shall allow project field staff with password privileges to manually override motorist's information messages for a user-specified duration, after which automatic operation will resume with display of messages appropriate to the prevailing traffic conditions.

i. The RTTM system shall be capable of providing current operational status (i.e. current traffic data and messages, CCTV cameras and video, communications system, signs and sensors) via the dedicated project RTTM website.

j. To provide for remote sign operation, the Website shall allow password-protected MassDOT operators to manually override the automated messaging in order to display a message at any time. The operator shall be able to send a pre-programmed or custom message to one sign or multiple signs without sending the identical message to all PCMS'. The operator shall be able to cancel this manual override and initiate any and all of the systems automated messaging features at any time.

k. The default and advisory message content is shall be programmable from the RTTM website accessed by MassDOT.

l. The system shall autonomously restart in case of power failure in any part of the system.

m. Each Portable Changeable Message Sign (PCMS) to be used as part of the RTTM system shall be a full-matrix LED display and shall conform with Section 6 of the MUTCD. All

messages shall be as defined on plans, in this specification and as coordinated and approved by MassDOT.

n. The dedicated project RTTM website shall provide a full color map depicting the project area with locations of PTS, CCTV Cameras and PCMS. The graphical representation of each device location is based on lat/long coordinates. The map shall reflect the current traffic conditions at each PTS and display the entire information message being shown by each PCMS.

o. The website shall allow MassDOT's own website or project specific website to link to it.

Data Requirements

The following data acquisition requirements are to be met:

a. All traffic data acquired by the RTTM system including but not limited to, calculated data fields, shall be archived in a log file with time and date stamps for the duration of the project. During the project, MassDOT shall have the ability to request any archived data from the RTTM vendor through the Contractor. The vendor shall provide this data to MassDOT within 5 days upon receipt of the original request in an approved format.

b. At the end of the project, the RTTM system vendor shall provide MassDOT all project archive data. This logged information will be in an MS Excel format for all traffic data provided in 15 minute intervals reported by device. Said intervals shall be provided on a lane by lane arrangement. The Contractor shall coordinate with MassDOT on appropriate method of delivery for all project data (DVD, portable media device, external website posting, FTP etc..). The contractor shall also supply a map displaying the locations of all equipment with its unique device identifier used as part of the RTTM system. Accompanying this map shall be a detailed description of where each device was installed (shoulder, median, overhead structure location), what lanes the devices were collecting data on (if applicable), how lanes relate to the device and data fields recorded as well as latitude and longitude coordinates for each device.

c. The vendor shall only modify the format of the data to be provided upon approval from MassDOT.

d. Each RTTM device shall have a unique device identifier. These identifiers shall be coordinated with MassDOT and approved by MassDOT at the beginning of the project and shall not change unless approved by MassDOT.

RTTM System Motorist Information Messages

The following messaging requirements are to be met:

a. The RTTM system PCMSs shall be capable of providing speed, delay, length of traffic queue, travel time and lane closure advisories to motorists.

b. The RTTM system shall have capacity to preset up to 20 different default or automatic advisory messages for each PCMS.

Message Sets:

a. If the current speed on an approaching roadway segment is at or above the speed limit, the upstream PCMS will display the message:

ROUTE X TO XX MILES
ROUTE Y XX MIN
EXIT XX XX:XX XX
Or another MassDOT approved message

b. If the current speed drops to less than 35 MPH but greater than or equal to 16 mph, the following message will be displayed on the approaching PCMS:

ROUTE X TO XX MILES
ROUTE Y XX MIN
EXIT XX XX:XX XX
Or another MassDOT approved message

c. If the current speed on the approaching roadway drops to less than 15 mph the following message will be displayed on the PCMS's:

ROUTE X XX MILES
TO EX Y XX MIN
HVY TRAF XX:XX XX
Or another MassDOT approved message

d. The sequences above are a minimum requirement and can be adjusted by MassDOT their discretion.

RTTM System Deployment (Field Installation)

The PCMS and CCTV Cameras of the RTTM system shall be installed in close proximity to the locations identified on the Traffic Management Plan. Spacing, number and location of PTS shall be as required based on the system provided by the RTTM Contractor.

The Contractor shall coordinate all proposed equipment field locations with MassDOT prior to and during installation as directed by MassDOT.

The Contractor shall prepare the locations to receive the equipment in accordance with the equipment manufacturer's requirements.

The Contractor shall install each component of the RTTM system in accordance with the manufacturer's recommendations in compliance with all industry standards and codes such that the RTTM system is fully operational and can be operated and controlled from a website portal provided for MassDOT's use.

The Contractor shall coordinate the work with other contractors as designated by MassDOT to complete installation and integration of all equipment for all system types. The Contractor shall

furnish and install all necessary materials and equipment for the RTTM system to provide a complete operational system that can be viewed and operated from the website interface by MassDOT or other approved parties.

All equipment shall be located within the public way. Any device placed within the public way must meet the clear zone requirements established in the latest edition of the AASHTO Roadside Design Guide unless specified on the plans, or as directed by MassDOT. If the device is located within the clear zone it shall be protected in accordance with MassDOT and AASHTO requirements. Any such protection necessary shall be considered incidental to the item and no separate payment will be made for providing such protection.

Any relocation and removal of equipment will be included in the installation cost as referenced in the Contract Documents.

The decision to add, relocate or remove individual devices or the entire RTTM system shall be made by MassDOT.

Operational Test

Once the RTTM system is fully installed and functioning, it shall undergo a seven-day operational test. The operational test shall include a test of the system in operation during normal traffic conditions, as well as during a lane closure(s) at the discretion of MassDOT, to ensure that all RTTM system equipment (including the portable changeable message signs, portable traffic sensors, central computer, communication devices, CCTV Cameras and website) are operating in a fully functional manner in conformance with the Contract Documents and this special provision for a duration of at least seven (7) calendar days. During this time the messages displayed on the RTTM PCMS shall be as follows:

Mile marker X	distance
Mile marker Y	travel time
	Current time
Or another MassDOT approved message	

The Contractor shall provide for complete operations support from the vendor during the operational test, and the Contractor shall provide verification, utilizing a method approved by MassDOT, that the reported drive time through the work zone accurately reflects actual field conditions. If any equipment malfunctions occur for a combined period of eight (8) hours or more during this operational test on any day, no credit will be given for that day for the operational test period, and the seven-day operational test will reset.

The Contractor shall maintain accurate records of equipment stoppages and resumptions during the seven-day operational test for submission to MassDOT for approval. In the event that ten percent or more of the time similar malfunctions occur that affect the proper operation of the RTTM system, MassDOT may declare a system component defective and require replacement of the equipment at no additional cost. When a RTTM system component defect is declared, the Contractor shall provide field testing and sufficient data to demonstrate that the deficiently has been corrected and the system is operating per this special provision.

The Contractor shall submit a report to MassDOT detailing the daily activity of the RTTM system during the operational test. The report shall indicate the date and time of any activity necessary to maintain operation of the RTTM system during the operational test period. Each entry shall include the following information:

- Identity of the equipment on which work was performed.
- Cause of equipment malfunction (if known).
- A description of the type of work performed.
- Time required to repair the equipment malfunction.

Once the operational test report is received and approved by MassDOT, the RTTM system will be considered operational and the system will be accepted for use.

Training And Support

The following personnel, training and support shall be required:

a. Contractor shall ensure that the RTTM system is furnished, installed and maintained by personnel who are experienced in this type of work. Deploying firm/personnel must have a minimum of five similar deployments.

b. Contractor shall ensure that an on-site specialist, who is capable of troubleshooting and correcting any issues with all the RTTM system equipment and software is locally available 24 hours a day, 7 days a week to maintain the system components, move portable devices as necessary and to respond to emergency situations within 4 hours. Ensure that this specialist is equipped with sufficient resources to make needed corrections of deficiencies within 8 hours of notification.

c. Training will be provided to project staff on the use and operation of both the physical field hardware and the electronic version (website) of the RTTM system.

d. The Contractor shall provide training of up to eight (8) hours for MassDOT personnel and their agents on the use and operation of both the physical field hardware and the electronic version (website) of the RTTM system. The Contractor is to coordinate with the MassDOT as to the exact location and time of the training.

e. Training shall be completed 14 days prior to the closure of the Callahan Tunnel or as directed by MassDOT. It is the responsibility of the Contractor to provide training manuals, class notes, and other instructional materials for up to twenty (20) attendees at the training session. No training shall begin unless and until, in the opinion of MassDOT that, the RTTM system is sufficiently complete and operational such that the training would be useful at the time.

System Operational Performance

The following operational performance requirements shall be met:

a. To ensure a prompt response to incidents involving the integrity of the RTTM system devices, the Contractor shall be required to make all necessary corrections to any and all

of the components of the RTTM system (with the exception of MassDOT supplied devices and the contractor supplied website) within 12 hours of notification by MassDOT. If all corrections are made within this 12-hour period and the system is brought back on-line, no pay reduction will occur. If the 12-hour timeframe expires and the components of the system are not fully restored to proper working order, payment deductions for the system will be made for that day and daily until such time as the entire system is brought back on-line at the discretion of MassDOT. The payment deduction will be determined as follows:

1 day = $10,000.00	6 days = $60,000.00
2 days = $20,000.00	7 days = $70,000.00
3 days = $30,000.00	8 days = $80.000.00
4 days = $40,000.00	9 days = $90,000.00
5 days = $50,000.00	10 days = $100,000.00

Each 24 hour period in excess of the initial 12 hour period during which the RTTM system is not working will be measured as one (1) day.

b. If the components of the RTTM system are down for more than 10 total days in a month whether they are consecutive or cumulative, then MassDOT reserves the right to require removal of the RTTM system at this time and replacement with a different system. The Contractor shall continue to be penalized at the payment deduction of $10,000.00 per day for each day, after the initial 10 day penalty that the system is out of compliance with this specification.

Each 24 hour period in excess of the initial 12 hour period during which the RTTM system is not working will be measured as one (1) day.

c. MassDOT reserves the right to remove any RTTM system component at any time if it determines the system is not performing in accordance with this specification, in which no further payment shall be made.
d. If the system is not fully operational 21 days prior to the closure of the Callahan Tunnel, a pro-rated pay reduction as detailed above shall occur until the system is approved by MassDOT.

e. The RTTM system shall perform with no major malfunctions throughout the entire contract unless MassDOT requests the system to be removed. Malfunctions include, but are not limited to the inability of the equipment to provide accurate-real time delay or travel time information, inability to withstand a construction roadside environment or normal weather conditions, etc. MassDOT reserves the right to terminate this item at any time if it determines this RTTM system is not performing in accordance with this specification.

Method Of Measurement And Basis Of Payment

Item 856.3, REAL-TIME TRAFFIC MANAGEMENT SYSTEM FOR WORK ZONES, will be paid for at the Contract unit price lump sum complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

Payment for the RTTM system will be as following:

- 30% will be paid when the RTTM equipment is delivered to the job site.
- 15% will be paid when MassDOT approves completion of the seven day operational test.
- 15% will be paid after 45 days of full system operation.
- 15% will be paid after 90 days of full system operation.
- 25% will be paid after traffic in back in its original condition, the Contractor's equipment has been removed from the project, and all historical data has been provided to and approved by MassDOT.

The RTTM System shall be removed at the written direction of MassDOT upon the reopening of the Callahan Tunnel to General Traffic. Removal of the RTTM System and it components shall be considered incidental to Item 856.3 and no further compensation will be allowed.

Mobilization, installation, relocation, or removal of the RTTM system, or any of its components, from the project shall be considered incidental to Item 856.3 and no further compensation will be allowed.

Portable Traffic Sensors, CCTV Cameras and Portable Changeable Message Signs shall be considered incidental to Item 856.3 and no further compensation will be allowed.

Any type of permits, temporary traffic control, equipment, removal or installation of guardrail, concrete barrier, impact attenuators or traffic control devices, site work, grading or material placement to complete the installation of any of the RTTM equipment shall be considered incidental to Item 856.3 and no further compensation will be allowed.

The RTTM system operational costs shall be considered incidental to Item 856.3 and no further compensation will be allowed.

Payment deduction, if applicable, will be made under Contract Allowance Non Bid Payment Item as stated in the System Operational Performance Section.