PURCHASING DIVISION
CITY OF WORCESTER
MASSACHUSETTS 01608-1895
ROOM 201 - CITY HALL, 455 MAIN ST.
PHONE (508) 799-1220

SEALED BID INVITATION
(Supplies, Material, Equipment, Services)

AN EQUAL OPPORTUNITY AFFIRMATIVE ACTION EMPLOYER

SEALED BID NO. CR-8611-J6
DATE: December 10, 2025
CITY OF WORCESTER **Christopher J. Gagliastro, MCPPO** **Purchasing Agent**
BUYER: Jerry Kucera

NOTICE TO BIDDERS
TERMS AND CONDITIONS

All bids are subject to the terms and conditions and specificity herein set forth except where specifically deleted by the City of Worcester in Section No. 6 below.

COMPLETE ORIGINAL COPY (including ALL pages) OF THIS BID MUST BE SUBMITTED IN A SEALED ENVELOPE:

DATE: December 31, 2025 TIME: 10:00 A.M. LOCAL TIME

PLACE: Purchasing Division, Room 201, City Hall, Worcester, Massachusetts

MARK SEALED ENVELOPE **"Sealed Bid No. CR-8611-J6, Traffic Signal Equipment / DTM"**

The name and address of the bidder must appear in the upper left hand corner of the envelope. The City of Worcester is not responsible for bids not properly marked.

GENERAL

1. This Bid Invitation covers: Furnish and deliver miscellaneous traffic signal equipment as per the requirements and specifications of the City of Worcester Department of Transportation & Mobility for a period of one (1) year from date of contract and at the sole discretion of the City to renew for a second and third year. The options to be determined at the end of the current contract year. (See page 10)

2. A certified check or bid bond made payable to the "City Treasurer, City of Worcester" in the Amount of $ N/A must accompany this bid.

3. All bids received will be publicly opened and read in the Bid Room at City Hall at date and time shown above. **NO BID WILL BE ACCEPTED AFTER TIME AND DATE SPECIFIED**

4. A performance bond in the amount of $ N/A of the total dollar award is required.
5. A payment bond in the amount of $ N/A of the total dollar award is required.

6. All terms and conditions are applicable to this proposal except the following section numbers which are hereby deleted from this invitation: all apply

7. **Questions pertaining to this bid must be directed to Jerry Kucera via e-mail at kucerajs@worcesterma.gov**

8. The following meanings are attached to the defined words when used in this bid form.
   (a) The word "City" means The City of Worcester, Massachusetts.
   (b) The word "Bidder" means the person, firm or corporation submitting a bid on these specifications or any part thereof.
   (c) The word "Contractor" means the person, firm or corporation with whom the contract is made by carrying out the provisions of these specifications and the contract.
   (d) The words "Firm Price" shall mean a guarantee against price increases during the life of the contract.

9. Any prospective bidder requesting a change in or interpretation of existing specifications of terms and conditions must do so within five (5) days (Saturdays, Sundays and Holidays excluded) BEFORE scheduled bid opening date. All requests are to be in writing to the Purchasing Division (or e-mailed at: kucerajs@worcesterma.gov). *No changes will be considered or any interpretation issued unless the request is in our hands within five (5) days (Saturdays, Sundays and Holidays excluded) BEFORE scheduled bid opening date.*

10. The contractor will be required to indemnify and save harmless the City of Worcester, for all damages to life and property that may occur due to his negligence or that of his employees, subcontractors, etc., during this contract.

11. The Contract Agreement will be in the form customarily employed by the City of Worcester and is on file in the Purchasing Division at City Hall.

12. Bids which are incomplete, not properly endorsed, or signed, or otherwise contrary to these instructions will be rejected as informal by the Purchasing Agent. **Conditional bids will not be accepted.**

13. The Bidder must certify that no official or employee of the City of Worcester, Massachusetts is pecuniarily interested in this proposal or in the contract which the bidder offers to execute or in expected profits to arise therefrom, unless there has been compliance with provisions of G.L. C. 43 Sec. 27, and that this bid is made in good faith without fraud or collusion or connection with any other person submitting a proposal.

14. As the City of Worcester is exempt from the payment of Federal Excise Taxes and Massachusetts Sales Tax, prices quoted herein are not to include these taxes.

15. All prices are to be firm F.O.B. Destination, City of Worcester, Massachusetts, unless otherwise indicated by the City. **Time reserved for award is ninety days.**

16. In case of error in the extension prices quoted herein, the unit price will govern.

17. It is understood and agreed that should any price reductions occur between the opening of this bid and delivery of any order, the benefit of all such reductions will be extended to the City.

18. The City of Worcester reserves the right to reject any and all bids, wholly or in part, and to make awards in a manner deemed in the best interest of the City.

19. Awards will be made to the bidder quoting the lowest net price in accordance with the specifications.

20. The supplier will be bound by all applicable statutory provisions of law of the Federal Government, the Commonwealth of Massachusetts, the City of Worcester, and the Department of Public Safety of the Commonwealth of Massachusetts.

21. Any bid withdrawn after time and date specified, the bidder shall forfeit deposit on bid as liquidated damages.

22. The contractor will not be permitted to either assign or underlet the contract, not assign either legally or equitably any monies hereunder, or its claim thereto without the previous written consent of the City Treasurer and of the Purchasing Agent of the City of Worcester.

23. If this bid shall be accepted by the City, and the bidder shall fail to contract as aforesaid and to give a bond in the amount as specified in Section 4, within ten (10) days, (not including Sunday or a legal Holiday) from the date of the mailing of a notice from the City to him/her, according to the address given herewith, that the contract is ready for signature, the City may by option determine that the bidder has abandoned the contract and thereupon the proposal and

acceptance shall be null and void and the bid security accompanying this proposal shall become the property of the City as liquidated damages.

24. When quoting, the bidder shall submit a signed copy of this bid form, and if bid accepted by the City shall constitute part of the contract of purchase. Do not detach any part of this form 30B (Sealed Bid Goods & Services) when submitting a bid. Bidder must sign and return complete form 30B (Sealed Bid Goods & Services).

25. If in the judgment of the Purchasing Agent any property is needlessly damaged by an act or omission of the contractor or his/her employees, servants or agent, the amount of such damages shall be determined by the Purchasing Agent of the City of Worcester and such amount shall be deducted from any money due the contractor or may be recovered from said contractor in actions at law.

26. It is agreed that deliveries and/or completion are subject to strikes, lockouts, accidents and/or Acts of God.

INSURANCE AND WORKER'S COMPENSATION

27. COMMERCIAL GENERAL LIABILITY INSURANCE: Contractor to supply the City of Worcester with certificates of insurance evidencing general liability coverage of not less than $ 1,000,000.00 per occurrence / $ 2,000,000.00 aggregate.

28. AUTOMOBILE LIABILITY INSURANCE: Contractor to supply the City of Worcester with certificates of insurance evidencing automobile liability coverage, bodily injury and property damage combined single limit, of $ 1,000,000.00 (all owned, hired, and non-owned autos).

29. COMPENSATION INSURANCE: The contractor shall furnish the City of Worcester with certificates showing that all of his/her employees who shall be connected with this work are protected under Massachusetts' statutory worker's compensation insurance policies.

30. The Contractor shall carry public liability insurance with an insurance company satisfactory to the City so as to save the City harmless from any and all claims for damages arising out of bodily injury to or death of any person or persons, and for all claims for damages arising our of injury to or destruction of property caused by accident resulting from the use of implements, equipment or labor used in the performance of the contractor or from any neglect, default or omission, or want of proper care, or misconduct on the part of the Contractor or for anyone of his employ during the execution of the contract.

31. Prior to starting on this contract, the Contractor shall deposit with the Contracting Officer certificates from the insurer to the effect that the insurance policies required in the above paragraphs have been issued to the Contractor. The certificates must be on a form satisfactory to the Purchasing Agent.

32. Except as may otherwise be stated herein, the Contractor shall also carry bodily injury and property damage insurance in an amount not less than those set forth above covering the operation of all motor powered vehicles owned or operated by the Contractor and engaged in this contract.

DISCOUNT

33. Prompt pay discounts will be considered when determining the low bid except when discounts are for a period of less than 30 days. In this event discounts will not be taken into consideration when determining low bid.

34. Time, in connection with discount offered, will be computed from date of completion and/or delivery and acceptance at destination, or from date correct bill or voucher properly certified by the contract is received if the latter date is later than the date of completion and acceptance and/or delivery and acceptance.

GUARANTEE

35. The bidder to who a contract is awarded guarantees to the City of Worcester all equipment, materials and or workmanship for a period of one (1) year after final inspection and acceptance and shall replace promptly any defective equipment, materials and/or workmanship required without additional cost to the City.

DELIVERIES AND COMPLETION

36. It is understood and agreed that in the event of failure on the part of the bidder to indicate date of delivery and/or completion, delivery and/or completion will be made within twelve (12) days from date of notification. Should the successful bidder fail to make delivery or complete contract within time specified, the City reserves the right to make the purchase on such orders at the open market and charge any excess over contract price to the account of the successful bidder, who shall pay the same.

37. The contractor shall familiarize himself with the location and facilities for storage.

38. The City through its Purchasing Division reserves the right to divert delivery from one location to another, and to allow for any change in operating conditions or for any other cause not now foreseen and to proportion deliveries according to available storage facilities.

SAMPLING AND ANALYSIS

39. Each bidder must state the commercial name of the product quoted, name, and address of operator or agent from whom the product will be purchased and in addition shall furnish an analysis of the product, date of analysis, by whom made and their address.

40. Samples of the product to be delivered may be taken by a representative of the City, either prior to delivery or while it is being delivered in the storage facilities at destination, or will be taken from the storage facilities to which the product has been delivered as determined from time to time by the Purchasing Agent. Bidder agrees to furnish the necessary manual labor, without additional cost required to assemble the physical samples, which is to be performed under the direction of the City representative.

41. The representative of the City taking the samples shall be given the opportunity, while sampling, to affix his or her signature to the delivery slip each item represented in his/her sample.

42. Any product after the sampling and analysis, not found meeting the requirements of the contract shall be sufficient cause for the cancellation of the contract at the option of the Purchasing Agent.

43. If any product is found that does not meet the analysis submitted by the bidder in his/her proposal, the Purchasing Agent may, at his or her option, exercise his/her right to reject the product and require that all or any part thereof shall be removed promptly by and at the expense of the contractor and replace it forthwith with a product satisfactory to the Purchasing Agent, or to retain the product and compensate the contractor in an amount as determined by the Purchasing Agent and the City Manager.

44. It is understood and agreed that it shall be a material breach of any contract resulting from this bid for the Contractor to engage in any practice which shall violate any provisions of Massachusetts General Laws, Chapter 151B, relative to discrimination in hiring, discharge, compensation, or terms, conditions or privileges of employment because of race, color, religious creed, national origin, sex, age or ancestry.

45. The undersigned as bidder, declares that the only parties interested in this proposal as principals are named herein; that this proposal is made without collusion with any other person, firm or corporation, that no officer or agent of the City is directly or indirectly interested in this bid; and he/she proposes and agrees that if this proposal is accepted he/she will contract with the City in accordance with the specifications, also the terms and conditions as spelled out in this bid form.

46. No Person, including but not limited to corporations, partnerships, limited partnerships or limited liability corporations, shall be eligible to receive a contract under this invitation to bid and/or requires for proposal if that person has been convicted of any felony offense involving the distribution of controlled substances as that term is defined under Chapter 94C of the General Laws and, for contracts to be performed for on-site services to the Worcester Public Schools, if that person or any person to be employed by that person in the performance of such on-site services has been convicted of a “sex offense” or a “sex offense involving a child” or a “sexually violent offense” or would meet the definition of “sexually violent predator” as those terms are defined in Section 178C of the General Laws and who must register with the sex offender registry board.

47. The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ for work or services relating to this contract any unfit person or anyone not skilled in the task assigned to him. In light of the fact that the performance of this contract requires the Contractor and its employees to have significant interaction with the public, the Contractor shall require all employees who may perform services under this contract to conduct themselves in a courteous, professional manner. If the Contractor is notified by the Contract Officer that any person engaged upon the work is incompetent, unfaithful, disorderly, discourteous, or otherwise unsatisfactory, then such person shall be discharged from providing services or work pursuant to this contract. Without limiting the generality of the foregoing, intimidation, threats and/or violent conduct of any kind or nature directed to members of the public are absolutely prohibited. Failure to comply with this requirement shall be grounds for termination of the contract.

48. The Contractor's performance may be evaluated on an ongoing basis including but not limited to consideration of complaints received from members of the public. In order to facilitate this evaluation, the Contractor shall provide the City with documents and records upon request. The Contractor shall further obtain from its employees authorization that appropriate City personnel may obtain all available criminal offender information ("CORI") from the Criminal History Systems Board. A high number of unresolved complaints, any number of complaints that are particularly severe, or employment of individuals who have been convicted or assault or other violent crimes shall be grounds for the early termination or non-renewal of the contract by the City.

49. The procurement officer shall award the contract to the lowest responsible and responsive bidder. The term "responsible bidder" means "a person who has the capability to perform fully the contract requirements, and the integrity and reliability which assures good faith performance." Consistent with its duty to maintain public order and promote public safety, the City has determined that this contract is of a type and nature so as to be particularly sensitive due, at least in part, to the contractor's inherent access and dealings with the members of the general public. Therefore, the City has concluded that additional scrutiny is justified as it determines whether a particular bidder is responsible, having the integrity and reliability to properly perform the requested services. This may entail consideration of the contractor's system of oversight, training and supervision of its employees, including but not limited to its requirement of a high standard of customer service and courtesy in its dealings with the public. The bidder's care and diligence in hiring and assigning its employees will also be considered. In making its determination, the City reserves the right to examine any and all information at its disposal, including but not limited to prior City contracts, the experiences and information obtained from current and former customers (whether identified by the bidder as references or not), as well as other sources available to the City, including but not limited to court documents, newspapers, financial reports (such as DUNS), and certain police data and reports.

50. The Contractor, acting through its owner(s) or any of its employees, or its agents or sub-contractors and any of their employees, shall not engage in any behavior, whether during the course of its duties under this contract or at any other time, that is illegal, criminal or otherwise shocking or offensive to the general public. The determination whether any particular behavior is illegal, criminal or shocking to the general public shall rest in the sound judgment of the Contracting Officer or the City Manager. In making such determination, the Contracting Officer or the City Manager shall apply the general standards of the community. No criminal conviction or formal charges shall be required to make such determination. Such behavior need be something more than trivial and something which would cause the general public to have concerns either about the safety of individuals coming in contact with the Contractor or about the character and integrity of the individuals with which the City does business. Violation of this provision shall be grounds for immediate and unilateral termination of this contract by the City upon five days' notice as otherwise provided herein

GIVE FULL NAMES AND RESIDENCES OF ALL PERSONS INTERESTED IN THE FOREGOING PROPOSAL.

(NOTICE: Give first and last name in full; in case of corporations, give corporate name and names of President, Treasurer, and Manager; and in case of firms give names of the individual members)

Name Address Zip Code

_____

_____

_____

_____

KINDLY FURNISH THE FOLLOWING INFORMATION REGARDING BIDDER:

(1) If a Proprietorship

Name of Owner _____

Business Address _____

Zip Code _____ Telephone No. _____

Home Address _____

Zip Code _____ Telephone No. _____

(2) If a Partnership
Full names and addresses of all partners

Name Address Zip Code

_____

_____

_____

Business Address _____Zip Code _____

Tel. No. _____

(3) If a Corporation

Full Legal Name _____

State of Incorporation _____ Qualified in Massachusetts ? Yes _____ No _____

Principal Place of Business _____
Street P.O. Box

_____
City/Town State Zip

Telephone No. _____

Place of Business in Massachusetts _____
Street P.O. Box

_____
City/Town State Zip

Telephone No. _____

GIVE THE FOLLOWING INFORMATION REGARDING SURETY COMPANY

Full Legal Name of Surety Company _____

State of Incorporation _____ Admitted in Massachusetts ? Yes _____ No _____

Principal Place of Business _____
Street P.O. Box

_____
City/Town State Zip

Place of Business in Massachusetts _____
Street P.O. Box

_____
City/Town State Zip

Telephone No. _____

NOTE
The Office of the Attorney General, Washington, D.C. requires the following information on all bid proposals amounting to $1,000.00 or more.

F.I.D. Number of bidder _____

This number is regularly used by companies when filing their "EMPLOYER'S FEDERAL TAX RETURN, U.S." Treasury Department Form 941.

AUTHORIZED SIGNATURE OF BIDDER _____ TITLE _____
PLEASE SIGN

DATE _____ BID SECURITY $_____

The name of Customer Service Representative and the Contract Administrator responsible for servicing this account in the event of contract award are:

_____ _____
NAME (PLEASE PRINT) *Customer Service Rep.* TEL. NO.

_____ _____
NAME (PLEASE PRINT) *Contract Administrator* TEL. NO.

FAX NUMBER **FAX #** _____

E-MAIL (Customer Service Rep.): _____

E-MAIL (Contract Administrator): _____

UNDER MASSACHUSETTS GENERAL LAWS, CHAPTER 30B: SECTION 10, THE FOLLOWING CERTIFICATION MUST BE PROVIDED:

Section 10. A person submitting a bid or a proposal for the procurement or disposal of supplies, or services to any governmental body shall certify in writing, on the bid or proposal, as follows:

" The undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals."

(Please Print) _____
Name of Person Signing Bid

_____
Signature of Person Signing Bid

_____
Company

No award will be made without vendor certification of the above.

Bidders must state and identify the product offered, such as manufacturer's name, trade name, brand name and quality next to each item. WE MUST KNOW WHAT HAS BEEN OFFERED.

The quantities shown herein are estimated only and the Contractor will be required to furnish all quantities ordered by the City during the period of the contract.

YES X NO_____

Delivery to be made to: _Worcester Department of Transportation & Mobility locations as required

This Bid includes addenda numbered _____

NO PRICE ADJUSTMENTS ALLOWED. PRICES QUOTED ARE FINAL. CHECK BEFORE SIGNING!

BIDDER TO COMPLETE ITEMS BELOW

Item No.	Estimated Quantity	Description	Mfg		Unit Price	
		Furnish and deliver miscellaneous traffic signal equipment as per the requirements and specifications of the City of Worcester Department of Transportation & Mobility for a period of one year from date of contract. **Award to be made on a line item basis. Bidders may bid on any or all items.**			**See pricing pages**	

TERMS, PROMPT PAY DISCOUNT _____% 30 DAYS, NET 45 DAYS.

DELIVERY AND/OR COMPLETION TO BE MADE WITHIN _____ DAYS FROM DATE OF NOTIFICATION BY THE CITY.

NAME OF BIDDER_____

DISCLOSURE OF CONTRACT RENEWAL

This contract may be renewed for a second and third year at the sole discretion of the City of Worcester, the option of which will be determined at the end of the current contract year.

In no event will increase exceed _____ % for the second contract year.
(TO BE COMPLETED BY BIDDER)

In no event will increase exceed _____ % for the third contract year.
(TO BE COMPLETED BY BIDDER)

_____ _____
Name Date

_____
Title

IF VENDOR DOES NOT WISH TO BE CONSIDERED FOR A SECOND AND THIRD YEAR OPTION, PLEASE INDICATE BY CHECKING THIS BOX: ☐

IMPORTANT

It is understood and agreed, that failure by the bidder to complete the above increase statement, it is the bidders intent to accept a second and third year option at zero (0) percent increase.

All other Terms and Conditions to remain the same.

STANDARD SPECIFICATIONS

All traffic signal equipment listed below must confirm to the latest edition of the Massachusetts Department of Transportation Standard Specifications for Highways and Bridges and be approved for use under the MassDOT Qualified Traffic Control Equipment (QTCE) list.

Item #	Quantity	Unit	Description
601.00	15	each	Controller-TS 2 Type 2
601.10	5	each	Controller Wiring Harness
602.00	3	lump sum	Controller Cabinet Assembly-Type P-Per Spec
602.05	2	each	Controller Cabinet Shell Only, Type P
602.10	1	lump sum	Controller Cabinet Assembly-Type M-Per Spec
602.15	1	each	Controller Cabinet Shell Only, Type M
602.50	20	each	MMU2-16LEIP Series Management Malfunction Unit
602.81	10	each	Opticom 2-Channel Phase Selectors (700 series)
602.82	10	each	Opticom 4-Channel Phase Selectors (700 series)
602.83	10	each	White Conformation Strobe Indicator for Preemption
602.84	16	each	Opticom Detector (700 series) — One-Way Direction
602.85	8	each	Opticom Detector (700 series) — Two-Way Direction
603.70	10	each	24V 5A shelf Mount Power Supply for TS-2 Cabinet
603.75	1	each	16-Channel 10-POS Detector Rack w/Opticom Compatibility
604.00	3	each	Video Detection – Complete System
604.02	1	each	16 Channel TS 2 Cabinet Detector Rack With BIU
604.07	4	each	Video Detection Camera With Radar And Mounting Hardware
604.08	5	each	Video Detection Camera Surge Protection Panel
604.10	1	each	Rack-Mount Video Detection Processor (4-Channel)
604.15	1	each	Rack-Mount Video Detection Processor Extension Module
604.60	25	each	Galaxy Camera Bracket w/74" Gusseted Tube, Vinyl Insert, and Detector Mounting Hardware
605.10	1	each	Central Control Unit (1-U Rack Mount)
605.20	1	each	Central Control Unit (Shelf-Mounted; TS 1) With Power Supply

STANDARD SPECIFICATIONS

Item #	Quantity	Unit	Description
605.30	2	each	Central Control Unit (Shelf-Mounted; TS2-Four Sensor) With Power Supply
605.30a	2	Each	Central Control Unit (Shelf-Mounted; TS2-Eight Sensor) With Power Supply
607.10	5	each	CAT5e Direct Burial Shielded Cable (1000 ft)
607.15	3	each	CAT5e Shielded Pass Through RJ45 Connectors (100-pack)
608.00			Traffic Signal Heads
608.20	50	each	12” Tunnel Visor for Traffic Signal
609.01	50	each	16" Countdown LED Pedestrian Signal Heads w/Visors-Complete
609.10	100	each	16" Countdown LED Pedestrian Modules
609.30	50	each	16" Open Pedestrian Visors
610.00	30	lump sum	Rectangular Rapid Flashing Beacon Assembly
610.10	2	each	RRFB Control Cabinet
610.20	5	each	RRFB Controller
610.30	2	each	RRFB Solar Charge Controller
610.35	10	each	RRFB 115-Watt Solar Panel
610.40	2	each	RRFB 105 Ah Battery
610.45	2	each	RRFB Wireless Transceiver
610.50	2	each	RRFB Crosswalk Illuminator
610.55	10	each	RRFB Light Bar
610.60	10	each	RRFB Audible Push Button
610.80	10	each	RRFB Pole and Base
611.00			Accessible Pedestrian Signal
611.10	1	each	APS Intelligent Central Control Unit (ICCU)
611.12	50	each	APS Ped Head Control Unit (IPHCU)
611.16	8	each	APS Push Button (2-Wire)
611.18	50	each	APS Push Button (3-Wire)
612.00			Traffic Signal Posts and Hardware
612.01	25	each	Traffic Signal Poles-9 ft. Standard

STANDARD SPECIFICATIONS

Item #	Quantity	Unit	Description
614.00			Mast Arms, Posts, and Bases
614.50	25	each	Mast Arm Bases – Breakaway 20” bolt pattern on bottom (TB4)
614.60	5	each	Mast Arm Ornamental Bases Only-Valmont Type
614.70	5	each	Mast Arm Ornamental Bases Only -Union Metal Type
614.80	25	each	Aluminum Octagonal Traffic Signal Base w/Threaded Steel Coupling (356 alloy/B-26, Black Powder Coat)
614.89	30	each	Opticom Band Mounting Hardware Kits for Mast Arms
614.91	10	each	Rigid Mast Arm Hanger Body Assembly (SE-3056 or approved equivalent)
616.00	50	each	12" Red LED Ball Indication
616.10	10	each	12" Red LED Arrow Indication
616.20	10	each	12" Red LED for 3M Programmable signals
616.30	50	each	12" Green LED Ball Indication
616.40	10	each	12" Green LED Arrow Indication
616.50	10	each	12" Green LED For 3M Programmable Signals
616.60	50	each	12" Amber LED Ball Indication
616.70	10	each	12" Amber LED Arrow Indication
616.80	10	each	12" Amber LED for 3M Programmable Signals
618.00	5000	linear foot installed	Fiber Optic Interconnect Cable (Master to Locals) or (Locals to Locals)

PAINTING OF SIGNAL EQUIPMENT

All new traffic signal equipment shall be powdered coated Black and as noted below

Equipment	Color
Vehicular signal housing	Black
Pedestrian signal housing	Black
Signal housing supports	Black
Signal support hardware	Black
Controller cabinet (exterior)	Black

STANDARD SPECIFICATIONS

Controller cabinet (interior)	White
Front of signal housing	Flat Black
Visors of signal housing	Black
Mast Arm ornamental Bases	Black
Mast Arm — Steel	Black
Octagon Traffic Signal Bases	Black
All mounting hardware (except Astro-Brac)	Black

Section 600--TRAFFIC SIGNAL EQUIPMENT

601.00 – CONTROLLER-TS 2 TYPE 2 EACH

General

The controller unit shall be a Yunex m60-series or approved equivalent. It shall be user-friendly, fully actuated, keyboard entry menu driven, with internal time base coordination capability, internal time clock and emergency preemption without the need for external equipment. The controller shall conform to Section 800 of the MSSHB Standard Specifications. The controller shall be compatible with a master controller, the City of Worcester's current traffic responsive signal system (TACTICS) and the City of Worcester Centralized Traffic Management System Software (CTSS), while conforming to all applicable requirements of NEMA Standard TS 2 Type II.

The controller shall provide an integrated communications module with Ethernet ports, USB ports, and "D" Connectors. These connectors shall enable communication among malfunction management units, conflict monitors, detectors, video-detection systems, and all other cabinet-based TS 1 or TS 2 devices. They shall also provide connectivity for signal coordination and remote management. The controller must be capable of operating in either single or dual ring mode with either sequential or concurrent phase control. Adapters shall be supplied to connect the controller in either a TS 1 or TS 2 configuration. Overlap phases shall be programmable through the keyboard and be capable of operating as a volume density controller. The controller shall contain all the necessary hardware to operate as a Closed Loop System. An operation manual and graphics shall be supplied for each controller. The controller shall contain all the necessary hardware, including cables and internal system modem and security controlled external modem connected to either telephone or fiber optic communications system. When assigning the phasing and sequence, phase 9 shall always be programmed for an exclusive pedestrian phase. The controller shall have a 16-line LCD display that displays 2 separate operations of the controller and 5 programmable function keys. The controller shall contain a communications module that has 4 Ethernet ports, 4 USB ports, and a GPS port. Wiring Harness to be provided with each controller.

All traffic signal controllers shall be compatible with the existing interconnected system, and the CTSS. The controller unit shall retain all intersection data and controller programming in a plug-in memory module utilizing non-volatile EEPROM memory. The Real Time Clock shall be maintained by a battery backup during power outages. The controller shall be programmable for Daylight Savings Time.

The controller unit shall be capable of two (2) through sixteen- (16) phase operation and sixteen (16) keyboard programmable overlaps. The controller shall have internal pre-emption with capability of six (6) unique pre-empt sequences. Each pre-empt sequence shall be fully user programmable for timing and signal display in response to an individual pre-empt command input. The controller shall provide access for all preemption and coordination functions. The controller unit and all equipment shall have approved surge protection. The controller shall have a standard RS232 port for one (1) data transfer cable and one (l) printer cable provided with each unit. The controller shall be provided with a standard cable for connection from the controller to the pre-emption unit.

Timing circuits of the traffic signal controllers shall be fully digital and shall be as accurate as the 60 Hz power source with an input range from 105 VAC to 130 VAC, over a temperature range encountered in Massachusetts.

Measurement and Payment

Payment for this item shall be at the bid price per each item complete in place.

601.10 - CONTROLLER WIRING HARNESS EACH

602.00 - CONTROLLER CABINET ASSEMBLY-TYPE P-PER SPEC LUMP SUM

General

The controller cabinet shall be size "P", Type TS-2 and installed as required in the Section 800 of the Massachusetts Department of Transportation Standard Specifications for Highways and Bridges.

Specifications

Each cabinet shall be equipped with two (2) video detection dual channel video processors, an Integrated BIU and Video Detection Communications Module, and a Single Point Interface Ethernet Device with MPEG4/H.264 Video Streaming, all meeting the City of Worcester Specifications for Video Detection as described herein. The cabinet shall contain a 9" LCD color monitor. A watertight sealant shall be placed between the controller cabinet and the foundation. The top of the concrete base for the controller cabinet shall be approximately 12 inches above finish grade (minimum). The foundation shall provide a spare sweep as directed by the Engineer.

The cabinet is to be fabricated sheet metal, base mounted type. Cabinet shall be fabricated from a minimum thickness of 0.125-inch aluminum.

A National Grid approved 100-amp meter socket with bypass shall be mounted on the side of the cabinet. National Grid shall furnish and install the meter. The cabinet shall include four (4) video suppressors to allow conversion to video detection with ease. A separately fused, ground fault duplex fifteen (15) amps outlet on the door, a double duplex 15-amp outlet on the side panel and a light receptacle shall be installed for the power supply of additional equipment. Adequate 120V AC power terminals shall be provided. Lightning arresters of the rare gas type with auxiliary air gap shall be installed. All signal outputs shall be separately fused by cartage type fuse.

It is intended that all equipment be mounted and all necessary provisions for mounting and wiring of all equipment shall be made at the factory of the controller equipment manufacturer prior to shipping the cabinet and control components. All necessary terminal strips, brackets, etc. shall be installed at the factory. The controller cabinet rack assembly shall be equipped for an Opticom phase selector, including harness. Terminals for auxiliary equipment to be installed shall be clearly and permanently labeled as to functions. It is understood that all cabinets for the National Electrical Manufactures Association (NEMA) controllers of the same phase capacity in the City of Worcester are interchangeable. Thus, the amount of field wiring shall be kept to a minimum.

No equipment components shall be stacked. Brackets, shelves, hangers, or other supports designed to assure convenient accessibility for inspection and maintenance shall be installed at the factory. Adjustable aluminum shelving is required. No plywood shelving side panels or rear panels shall be used in any cabinet. A pull-out document drawer shelf shall be provided to store plans and provide a shelf for a laptop computer. A suitable weatherproof container for plans and diagrams shall be mounted on the cabinet door with eyehooks fastened from the panel" cover.

Each main door shall be designed to open easily and close securely while retaining weatherproof quality. Handle and latch mechanisms shall be designed for trouble free operations. An adjustable latching mechanism shall be supplied to hold the main door in the open position for use when servicing equipment. Each main door shall have a momentary push-button switch installed to provide an alarm to the system of any entries to the cabinet and provide automatic lighting within the cabinet.

A second hinged door, mounted on the main door, shall give access to designated switches on a "police panel". This door shall be provided with a different lock and key. Mounted within the "police panel" door shall be switches to control flashing operation and shutdown.

Each controller cabinet shall be equipped with a ruggedized gigabit-class 5G NR/Cat 20 LTE router (Ericsson Cradlepoint R1900-FIPS or approved equivalent) to allow communication to closed-loop monitoring and video service. Cabinet shall also include a compatible external weatherproof router antenna (Belgian Shepherd-Pro Series or approved equivalent) with all necessary mounting hardware and weather-sealing materials.

Cabinet shall include a ruggedized web-addressable remote power switch with surge protection, at least six 15A individually switched outlets (DLI .Pro Switch or approved equivalent), and mounting hardware for DIN rail integration. Power switch must be capable of scheduled or manual power cycling of individual outlets configured through a web interface. Power switch must include a configurable Ethernet interface.

Two thermostatically controlled exhaust fans, rated at 100 cubic feet per minute, shall be mounted in a screened opening in the top of each cabinet. Screened intake vent louvers near the bottom and/or sides shall have an effective area at least twice that of the opening provided for the exhaust fan. Standard size, replaceable, fiberglass air filters shall be provided.

Controller cabinet wiring diagrams shall be submitted on printed reproducible sheets no larger than 24 inches by 36 inches with electronic versions in AutoCAD-2018 and Adobe-PDF formats. All actual and potential terminal strip connections shall be shown. Accessory equipment includes, but is not limited to, flashers, switches, relays, logic modules, preempt phase selector, detectors, etc. All identification on the diagram shall be installed and all field labeling shall be consistent with the diagrams. The format symbols, identifications, operating sequence, etc., common to all intersection wiring diagrams shall be standardized and consistent with appropriate City of Worcester Standards. The control cabinet wiring diagrams shall include a sketch of the intersection controlled and the approximate location and identification of each signal face and detector as shown on the plans. The control cabinet wiring diagrams shall also include all information shown on the phasing and timing charts as shown on the plans, including all special reference notes and all field labeling. This may be a reduced copy of the original phasing and timing charts. All actual and potential terminal strip connections shall be shown on the wiring diagrams. All holes and interior surfaces likely to carry a cable shall be deburred and made free of all sharp edges. All holes shall be sealed with a plastic or rubberized washer to prevent damage to cable. All wiring shall be concealed internally. All unused bays shall be covered to prevent dust from entering.

All Load Switches shall be a modular solid-state assembly with I/O and have L.E.D. indicators to show which I/O function is called for by the controller (i.e., Red, Yellow or Green), meet or exceed NEMA TS l- 1989 requirements and be listed on the MassDOT Qualified Traffic Control Equipment list (QTCE). The controller shall have a full complement of load switches.

All Relay Switches shall be a 30A modular solid-state assembly and meet or exceed NEMA TSI-1989 requirements and be listed on the MassDOT QTCE.

The Malfunction Management Unit (MMU2 700 series) shall comply with Section 4 of the NEMA TS-2 standards. The MMU2 shall be connected to the controller unit by the Synchronous Data Link Control (SDLC) and the active status of the MMU2 will be read through the controller unit and also thru a Closed Loop Communications System. The MMU2 shall have an Ethernet port, LCD display and shall work with all modes of FYA.

The Bus Interface Unit (BIU) shall meet or exceed all the requirements of the NEMA BIU2 TS2-2003 clause 8.3 standards for BIU configuration. All outputs are rate at 150mA continuous sink current and provide 500mA current limit. The BIU shall supply 4 optically insolated inputs.

A separate power supply shall be supplied and installed in the TS 2 cabinet. The unit shall be AC line powered and provide regulated DC power, unregulated AC power, and a line frequency reference for the rack mounted loop amplifiers, bus interface units, load switches and other auxiliary cabinet equipment as required including video detection. At a minimum, the power supply shall meet all requirements of Section 5.3.5 of the NEMA TS 2 Standard. The power supply shall be shelf mounted. The unit shall have at least the following four outputs with LED indicators on the front panel to indicate their status: +12 VDC rated at 5.0 amps, +24 VDC rated at 3.0 amps, 12 VAC rated at 250 milliamps, and 60 Hz line frequency reference. Test point terminals shall also be located on the unit's front panel for +12 VDC, +24 VDC, and logic ground testing.

A Synchronous Data Link Control (SDLC) Serial Bus shall conform to section TS2 Section 3.31 a SDLC to allow communications between the controller unit, MMU, and BIUs. Two (2) additional spare BIUs shall be equipped with each controller cabinet.

The Opticom detector rack shall be wired and one— four channel (4) Opticom Phase Selectors (700 series) capable of using IR and GPS activation technology. A pre-emption indicator light shall be provided and mounted at all locations as shown on the plans. It shall be located in a position where it may be visible from all pre-emption approaches to each intersection. The light shall be weather tight and consist of a single flash white strobe, which shall be illuminated whenever the controller is in the fire-pre-emption phase. The indicator light shall meet all ITE, NEMA, IMSA and Section 800 of the MSSHB standards. The light shall have a minimum diameter of five and one half (5-1/2") and be capable of flashing at a rate of 80 to 95 flashes per minute.

Cable installation

Cable from each local controller to each traffic signal shall have a minimum of Twenty (20) conductors #12 AWG, singles, stranded, IMSA Specification 19-1 1968 traffic control cable shall be used for signal cable.

Special purpose grounding and bonding wire shall be # 8 AWG or larger conforming to the requirements of ASTM B3.

Measurement and Payment

Payment for this item shall be at the bid price per each item complete in place.

602.05 – CONTROLLER CABINET SHELL ONLY, TYPE P EACH

602.10 - CONTROLLER CABINET ASSEMBLY-TYPE M-PER SPEC LUMP SUM

General

The controller cabinet shall be size "M", Type TS-2 and installed as required in the Section 800 of the Massachusetts Department of Transportation Standard Specifications for Highways and Bridges.

Specifications

See 602.00 – CONTROLLER CABINET ASSEMBLY-TYPE P for specifications other than cabinet type.

Measurement and Payment

Payment for this item shall be at the bid price per each item complete in place.

602.15 – CONTROLLER CABINET SHELL ONLY, TYPE M EACH

602.20 – SSS-87 STANDARD LOAD SWITCH W/I/O FUNCTIONS (200 TYP) EACH

602.30 - SSF-87 FLASHER LOAD SWITCH (204 TYP) EACH

602.40 - 30A RELAY SWITCH EACH

602.50 - MMU2-16LEIP SERIES MANAGEMENT MALFUNCTION UNIT EACH

602.51 - 12-CHANNEL CONFLICT MONITOR FOR CLOSED LOOP SYSTEM LEC EACH

602.52 – 6-CHANNEL CONFLICT MONITOR FOR CLOSED LOOP SYSTEM LEC EACH

602.60 - BIU 700 EACH

602.81 - OPTICOM 2-CHANNEL PHASE SELECTORS (700 SERIES) EACH

602.82 - OPTICOM 4-CHANNEL PHASE SELECTORS (700 SERIES) EACH

602.83 - WHITE CONFORMATION STROBE INDICATOR FOR PREEMPTION EACH

602.84 - OPTICOM DETECTOR (700 SERIES) — ONE-WAY DIRECTION EACH

602.85 - OPTICOM DETECTOR (700 SERIES) — TWO-WAY DIRECTION EACH

602.90 - COOLING FANS FOR CONTROLLER CABINET EACH

602.91 - THERMOSTATS FOR COOLING FANS IN CONTROLLER CABINET EACH

603.70 - 24V 5A SHELF MOUNT POWER SUPPLY FOR TS-2 CABINET EACH

603.75 – 16-CHANNEL 10-POS DETECTOR RACK W/OPTICOM COMPATIBILITY EACH

604.00 - VIDEO DETECTION-COMPLETE SYSTEM LUMP SUM

General

This specification sets forth the minimum requirements for a system that detects vehicle, bicycle, and pedestrian traffic on a roadway using only video images of traffic. The video detection system (VDS) shall be the Vantage NEXT platform manufactured by ITERIS (or approved equivalent) and shall be capable of integrating to a TS1 or TS2 cabinet with complete operation and management functionality in either environment.

System Hardware

The video detection system shall consist of at least four video cameras, a camera surge-protection panel, a video detection processor (VDP)/central control unit (CCU) which mounts on or to a standard NEMA cabinet shelf, a 10-inch monitor, and a pointing device. The system shall also include at least two detector-rack-mounted dual video processors and four detector-rack-mounted expansion modules.

System Software

The system shall include software that detects vehicles and bicycles in multiple lanes using only the video image. Detection zones shall be definable using only an on-board video menu and a pointing device to place the zones on a video image. Up to 32 detection zones per camera shall be available. A separate computer shall not be required to program the detection zones.

Functional Capabilities

The VDP shall process video from up to four camera sources, as specified. The video shall be input to the VDP from the camera sensors via Ethernet cables plugged into the of the CCU. The interface connectors shall be RJ-45 type.

The VDP shall detect the presence of vehicles in up to 32 detection zones per camera. A detection zone shall be approximately the width and length of one car.

Detection zones shall be programmed via an on-board menu displayed on a video monitor and a pointing device connected to the VDP. The menu shall facilitate placement of detection zones and setting of zone parameters or to view system parameters. A separate computer shall not be required for programming detection zones or to view system operation.

The VDP shall store up to five different detection zone patterns. The VDP can switch to any one of the three different detection patterns within one second of user request via menu selection with the pointing device.

The VDP shall detect vehicles in real time as they travel across each detector zone.

The VDP shall accept new detector patterns from an external computer through the Ethernet port when the external computer uses the correct communications protocol for downloading detector patterns. A

Windows-based software designed for local or remote connection and providing video capture, real-time detection indication and detection zone modification capability shall be provided with the system.

The VDP shall send its detection patterns to an external computer through the Ethernet port when requested. The VDP will accept new detector patterns from an external computer using the appropriate communications protocol for uploading.

The camera system shall be able to transmit a video signal, with minimal signal degradation, up to 1,000 feet under ideal conditions.

The associated VDP shall default to a safe condition, such as a constant call on each active detection channel, in the event of loss of video signal.

The system shall be capable of automatically detecting a low-visibility condition such as fog and respond by placing all defined detection zones in a constant call mode. A user-selected output shall be active during the low-visibility condition that can be used to modify the controller operation if connected to the appropriate controller input modifier(s). The system shall automatically revert to normal detection mode when the low-visibility condition no longer exists.

Vehicle Detection

A minimum of 32 detection zones shall be supported and each detection zone shall be user definable in size and shape to suit the site and the desired vehicle detection region.

A single detection zone shall be able to replace multiple inductive loops and the detection zones shall be OR'ed as the default or may be AND'ed together to indicate vehicle presence on a single phase of traffic movement.

Placement of detection zones shall be done by using only a pointing device, and a graphical interface built into the VDP and displayed on a video monitor, to draw the detection zones on the video image from the video camera. No separate computer shall be required to program the detection zones.

A minimum of five detection zone patterns shall be saved within the VDP memory. The VDP's memory shall be non-volatile to prevent data loss during power outages. The VDP shall continue to operate (e.g. detect vehicles) using the existing zone configurations even when the operator is defining/modifying a zone pattern. The new zone configuration shall not go into effect until the configuration is saved by the operator.

The selection of the detection zone pattern for current use shall be done through a menu or remote computer via Ethernet port. It shall be possible to activate a detection zone pattern for a camera from DVP memory and have that detection zone pattern displayed within 1 second of activation.

When a vehicle is detected crossing a detection zone, the corners of the detection zone will flash on the video overlay display screen to confirm the detection of the vehicle.

Detection shall be at least 98% accurate in good weather conditions and at least 96% accurate under adverse weather conditions (rain, snow, or fog). Detection accuracy is dependent upon site geometry; camera placement, camera quality and detection zone location, and these accuracy levels do not include allowances for occlusion or poor video due to camera location or quality.

Detector placement shall not be more distant from the camera than a distance of ten times the mounting height of the camera.

The VDP shall provide up to 64 channels of vehicle presence detection through a standard SDLC connector.

The VDP shall provide dynamic zone reconfiguration (DZR) to enable normal detector operation of existing channels except the one where a zone is being added or modified during the setup process. The VDP shall output a constant call on any detection channel corresponding to a zone being modified.

Detection zone setup shall not require site specific information such as latitude, longitude, date and time to be entered into the system.

The VDP shall output a constant call for each enabled detector output channel if a loss of video signal occurs. The VDP shall output a constant call during the background learning period.

Detection zone outputs shall be configurable to allow the selection of presence, pulse, extend, and delay outputs. Timing parameters of pulse, extend, and delay outputs shall be user definable between 0.1 to 25.0 seconds.

Up to six detection zones shall be capable to count the number of vehicles detected. The count value shall be internally stored for later retrieval through the Ethernet port. The data collection interval shall be user definable in periods of 5, 15, 30 or 60 minutes.

VDP Hardware

The VDP shall be specifically designed to mount in standard TS-1, TS-2, and 170 type cabinets.

The VDP shall operate in a temperature range from -34°C to +74°C and a humidity range from 0%RH to 95%RH, non-condensing.

The VDP shall be powered by 12 or 24 VDC. These modules shall automatically compensate for the different input voltages.

The VDP shall utilize flash memory technology to enable the loading of modified or enhanced software through the Ethernet port without modifying the VDP hardware.

The front of the VDP shall include detection indications, such as LEDs, for each channel of detection that display detector outputs in real time when the system is operational.

The VDP shall have full-function BIU and integrated video detection communication. The VDP shall provide outputs to the controller of vehicle calls from video processors that reside within the shelf mounted unit and in the detector rack.

The VDS shall have the capability of monitoring phase information and passing that information and other system data such as “time” from the controller to video detection processor modules. The VDP shall also accept data from video processor modules and relay the information to the controller. The unit shall provide a maximum of 64 detector outputs to the controller via the SDLC interface.

Video Detection Camera

The video cameras used for traffic detection shall be furnished by the VDP supplier and shall be qualified by the supplier to ensure proper system operation.

The VDS camera sensor shall utilize a single shielded CAT5E cable for power and video. Cable termination at the camera shall not require crimping or special tools. The cable termination shall only require a standard wire stripper and a screwdriver. No connectors (e.g., BNC) shall be allowed.

The camera sensor shall allow the user to set the focus and field of view via the VDS software. Camera sensor control from the controller cabinet shall communicate over a single CAT5E or CAT6 cable. No additional wires shall be required.

The camera shall produce a useable video image of the features of vehicles under all roadway lighting conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime to daytime, but not less than the range 0.003 lux to 10,000 lux.

The camera electronics shall include automatic gain control (AGC) to produce a satisfactory image at night for the VDS algorithms.

The imager luminance signal to noise ratio (S/N) shall be more than 50 dB with the automatic gain control (AGC) disabled.

The imager shall employ three-dimensional dynamic noise reduction (3D-DNR) to remove unwanted image noise.

The camera imager shall employ wide dynamic range (WDR) technology to compensate for wide dynamic outdoor lighting conditions. The dynamic range shall be greater than 100 dB.

The camera shall be digital signal processor (DSP) based and shall use a CCD sensing element and shall output color video with resolution of not less than 540 TV lines. The color CCD imager shall have a minimum effective area of 811(h) x 508(v) pixels.

The camera shall include an electronic shutter control based upon average scene luminance and shall be equipped with an auto-iris lens that operates in tandem with the electronic shutter. The electronic shutter shall operate between the range of 1/60th to 1/90,000th second.

The camera shall utilize automatic white balance.

The camera shall include a variable focal length lens with variable focus that can be adjusted, without opening up the camera housing, to suit the site geometry by means of a portable interface device designed for that purpose and manufactured by the detection system supplier.

The horizontal field of view shall be adjustable from 4.5 to 48 degrees. This camera configuration may be used for the majority of detection approaches in order to minimize the setup time and spares required by the user. The lens shall be a 12x zoom lens with a focal length of 3.5mm to 35mm.

The lens shall also have an auto-focus feature with a manual override to facilitate ease of setup.

The camera shall incorporate the use of preset positioning that store zoom and focus positioning information. The camera shall have the capability to recall the previously stored preset upon application of power.

The camera shall be housed in a weather-tight sealed enclosure. The housing shall allow the camera to be rotated to allow proper alignment between the camera and the traveled road surface.

The camera enclosure shall be equipped with a sunshield. The sunshield shall include a provision for water diversion to prevent water from flowing in the camera's field of view. The camera enclosure with sunshield shall be less than 3.5" (89mm) diameter, less than 5.25" (133mm) long, and shall weigh less than 2.5 pounds (1.14kg) when the camera and lens are mounted inside the enclosure.

The enclosure shall be designed so that the pan, tilt and rotation of the camera assembly can be accomplished independently without affecting the other settings.

Camera Lens

The camera enclosure shall include a proportionally controlled Indium Tin Oxide (ITO) lens coating for the heating element of the front glass that maximizes heat transfer to the lens. The output power of the heater shall vary with temperature, to assure proper operation of the lens functions at low temperatures and prevent moisture condensation on the optical faceplate of the enclosure. The transparent coating shall not impact the visual acuity and shall be optically clear.

The glass face on the front of the enclosure shall have an anti-reflective coating to minimize light and image reflections and will include a Titanium Dioxide self-cleaning coating.

When mounted outdoors in the enclosure, the camera shall operate satisfactorily in a temperature range from -30° F to +140° F (-34 °C to +60 °C) and a humidity range from 0% RH to 100% RH. Measurement of satisfactory video shall be based upon VDP system operation.

The camera shall be powered by 48VDC. Power consumption shall be 5 watts typical and 16 watts or less under worst conditions.

Recommended camera placement height shall be 33 feet (or 10 meters) above the roadway, and over the traveled way on which vehicles are to be detected. For optimum detection the camera should be centered above the traveled roadway. The camera shall view approaching vehicles at a distance not to exceed 350 feet (107 meters) for reliable detection (height to distance ratio of 10:100). Camera placement and field of view (FOV) shall be unobstructed and as noted in the installation documentation provided by the supplier.

The video signal shall be fully isolated from the camera enclosure. Cable terminations at the camera for video and power shall not require crimping tools.

A weather-proof protective cover shall be provided shall be provided to protect all terminations at the camera. No special tooling shall be required to remove or install the protective cap.

The camera assembly shall include a temperature sensor. The sensor will be polled by the VDS every minute and will supply the current air temperature. The VDS software will display this information on the On-Screen Display for each camera.

Installation

The cable to be used between the camera and the CCU in the traffic cabinet shall be CAT5E, shielded, direct burial cable. This cable shall be suitable for installation in conduit or overhead with appropriate span wire. Shielded RJ-45 connectors shall be used where applicable. The CAT5E cable, RJ-45 connector, stripping and crimping tool shall be approved by the supplier of the video detection system, and the manufacturer's instructions must be followed to ensure proper connection.

The video detection system shall be installed by supplier factory certified installers and as recommended by the supplier and documented in installation materials provided by the supplier. Proof of factory certification shall be provided.

Maintenance and Support

The supplier shall maintain an ongoing program of technical support for the video detection system and a limited two-year warranty on the video detection system.

The supplier shall supply management software with free software and device firmware upgrades (as needed) for the lifetime of the system. Upgrades shall be performed by the supplier in coordination with the end user.

604.02 – 16 CHANNEL TS 2 CABINET DETECTOR RACK WITH BIU EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

604.03 – TS1 CABINET DETECTOR RACK WITH POWER SUPPLY EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

604.05 – WDR VIDEO DETECTION CAMERA WITH MOUNTING HARDWARE EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

604.07 – VIDEO DETECTION CAMERA WITH RADAR AND MOUNTING HARDWARE EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

604.08 - VIDEO DETECTION CAMERA SURGE PROTECTION PANEL EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

604.10 – RACK-MOUNT VIDEO DETECTION PROCESSOR (4-CHANNEL) EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

604.60 – GALAXY CAMERA BRACKET W/74" GUSSETED TUBE, VINYL INSERT, AND DETECTOR MOUNTING HARDWARE EACH

605.10 – CENTRAL CONTROL UNIT (1-U RACK MOUNT) EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

605.20 – CENTRAL CONTROL UNIT (SHELF-MOUNTED; TS 1) WITH POWER SUPPLY EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

605.30 – CENTRAL CONTROL UNIT (SHELF-MOUNTED; TS2-FOUR SENSOR) WITH POWER SUPPLY EACH

Shall meet or exceed specification of component in Section 604.00 - Video Detection-Complete System.

607.10 – CAT5E DIRECT BURIAL SHIELDED CABLE (1000 FT) EACH

607.15 – CAT5E SHIELDED PASS THROUGH RJ45 CONNECTORS (100-PACK) EACH

608.00 – TRAFFIC SIGNAL HEADS

General

Traffic signal heads shall be standard aluminum traffic signals with weather-tight assemblies, complete with LED indicators, Black in color with Black fronts, and be listed on the in the approved Traffic Signal Controls section of the MassDOT QTCE. All red, amber, and green indications shall be LED, meeting or exceeding requirements of Section 616.00 – LED – Red, Green, And Amber Indications. Signals shall have tunnel visors with upper and lower mounting hardware. Signals shall provide accessibility to wiring without disassembling the hardware.

Measurement and Payment

608.05 - 12" Three-Section LED Traffic Signal w/Visors-Complete	each
608.10 - 12" Bi-Modal LED Left Turn Arrow w/Housings and Visor	each
608.20 – 12" Tunnel Visor for Traffic Signal	each
608.30 - 12" Geometrically Programmed Louver w/Black Visor and Adjustment Tool	each

609.00 - PEDESTRIAN SIGNALS

General

The countdown pedestrian signal heads shall be 16" LED countdown pedestrian signal module housed in an aluminum casing with visors. The signal shall consist of international symbols of an LED upright solid hand symbolizing "Don't Walk" and a solid walking person symbolizing "Walk". The internal countdown module shall be comprised of two 7 segment digits, 8 inches high and made of 88 Portland Orange LED's. The countdown module shall display the number of seconds remaining throughout the pedestrian clearance interval only and blank out when not activated. This programming function shall be available on the back of the pedestrian module. The intersection controller bases the clearance time upon the Don't Walk signal indications which automatically set the pedestrian countdown module. The countdown module shall continuously monitor the intersection controller for any changes to the pedestrian phase timing and reprogram itself automatically.

All pedestrian signals shall be a one-piece unit containing both the LED "HAND" and LED "FIGURE" fixture in the same unit with an open visor, with upper and lower mounting hardware. The LED countdown signal shall retain all timing information from the controller and not be adjusted in the pedestrian signal head. The countdown pedestrian signal heads shall comply with all standards and specifications of the latest edition of the MUTCD.

Measurement and Payment

609.01 - 16" Countdown LED Pedestrian Signal Heads w/Visors	each
609.10 - 16" Countdown LED Pedestrian Modules	each
609.30 - 16" Open Pedestrian Visors	each

610.00 – RECTANGULAR RAPID FLASHING BEACON ASSEMBLY LUMP SUM

Work under these Items shall conform to the relevant provisions of Section 800, of the Standard Specifications, the 2023 Manual on Uniform Traffic Control Devices (MUTCD), the MUTCD interim approval for optional use of rectangular rapid flashing beacons, and the National Electric Code.

The work shall include the furnishing of Rectangular Rapid Flashing Beacon system (TAPCO brand or approved equivalent) with 115-watt solar panel systems to be installed by others. Equivalent model must be able to fully integrate with Tapco controller for maintenance purposes.

The manufacturer shall offer a three-year unconditional warranty against all defects in material and workmanship.

The open ends of conduits entering or leaving strain poles, posts and pull boxes shall also be sealed with the approved elastic sealing compound.

The work under Item 610.00 will be paid for at the respective contract lump sum price, which shall include all compensation for the work, all labor, materials, and equipment necessary or incidental to the Rectangular Rapid Flash Beacon Assembly including but not limited to major items listed on the plans.

Description of Components

This assembly includes a complete functional RRFB system with RRFB Light Bars, iNX Push Buttons, Crosswalk Illuminators, 115-Watt Solar Panels, and Control Cabinets with Flash Controllers, Wireless Transceivers, 105Ah Batteries, Mounting Hardware, Static Signage, Poles, and Bases for both sides of a street. These components shall meet or exceed specifications in the following sections:

610.10 - RRFB Control Cabinet

610.20 - RRFB Controller

610.30 - RRFB Solar Charge Controller

610.35 - RRFB 115-Watt Solar Panel

610.40 - RRFB 105 Ah Battery

610.45 - RRFB Wireless Transceiver

610.50 - RRFB Crosswalk Illuminator

610.55 - RRFB Light Bar

610.60 - RRFB Audible Push Button

610.70 - RRFB Static Signs

610.80 - RRFB Pole and Base

General Requirements

The RRFB Light Bar Manufacturer shall have a minimum of ten years of relevant intelligent traffic product manufacturing experience, as well as a minimum of three years of RRFB Light Bar manufacturing experience.

Upon activation by pedestrian push button, the RRFB controllers shall activate all RRFB Light Bars in the crosswalk system simultaneously. RRFB Light Bars shall flash synchronously and then cease operation after a programmable timeout.

All proposed traffic signal equipment including but not limited to bases, doors, signal posts, pushbutton housings, controller cabinets (exterior), service meter socket box, hardware, and rigid mounting brackets for signals and signs shall be colored gloss Black, subject to the approval of the City.

610.10 – RRFB CONTROL CABINET EACH

RRFB Control Cabinet shall be NEMA 3R Type.

Shall be 21.1” tall x 17.5” wide x 11.6” deep and constructed of minimum 0.125" thick aluminum.

To promote airflow for internal components, the cabinet shall be vented with screening included on all vents and drains to prevent insects and other foreign matter from entering.

For security, the cabinet must include at least three tamper-resistant stainless-steel hinges and a replaceable #2 traffic lock with keys.

To facilitate maintenance or repairs, the cabinet shall include a removable control panel to which all control circuit components either mount or connect.

For easy installation on a wide range of pole sizes and types, the cabinet shall utilize six 5/16"-18 stainless steel mounting studs that mate to a range of bracket options. To ensure a secure mount to the supporting post, three banding style brackets that fit poles with a 2-3/8” or larger diameter shall be included as standard equipment. Mounting brackets also available for square pole, wooden post, and wall mount applications.

To prevent corrosion, all materials used in the construction or mounting of the control cabinet shall be either aluminum or stainless steel. Anti-vandal mounting hardware shall be available as an option.

A UV resistant label shall be applied to the exterior of the cabinet and include system specific information including model number, serial number, date of manufacture, as well as any applicable regulatory compliance information.

610.20 – RRFB CONTROLLER EACH

The RRFB Programmable Flash Controller is housed within the NEMA 3R type Control Cabinet, and shall:

Include integrated constant-current LED drivers with a minimum of two-channel output for driving one or two RRFB units.

Automatically adjust the LED drive current control to optimize brightness for the ambient lighting conditions determined by the phototransistor input.

Have the LED drive outputs reach the full output current as programmed within the duration of the 100ms on-time.

Include an integrated Real Time Clock (RTC) with on-board battery backup.

Have the capability of RS232 communication for programming with Windows-based software.

Include a minimum of two General Purpose Inputs and Outputs (GPIO).

Shall synchronize the system components to activate the indications within 120msec of one other and remain synchronized throughout the duration of the flash (timeout) cycle.

Shall operate on the license-free ISM band.

Shall comply with part 15 of FCC rules.

Shall operate from 3.3VDC to 15VDC.

Shall be, in the unlikely event of failure, replaceable independently of other components.

610.30 – RRFB SOLAR CHARGE CONTROLLER EACH

RRFB Solar Charge Controller shall utilize an intelligent 4-stage algorithm and Pulse Width Modulation (PWM) for battery charging.

Shall automatically provide Low Voltage Disconnect (LVD) to protect batteries when needed.

Shall automatically provide Load-Reconnection once battery levels have been restored to an acceptable value.

Shall protect against and automatically recover from: short circuit, overload, reverse polarity, high temperature, lightning and transient surge, as well as voltage spikes.

Shall be independently replaceable of other control panel components.

Shall operate from -40° to +140°F (-40° to +60°C).

610.35 – RRFB 115-WATT SOLAR PANEL EACH

RRFB 115-Watt Solar Panel shall be constructed of an anodized aluminum frame, high-transmission 1/8" tempered glass, with silicon cells encapsulated in double-layer EVA, and with a white polymer backing.

The Solar Panel shall be affixed to a pole top bracket that allows an adjustable angle to provide maximum insolation exposure

To ensure maximum solar insolation regardless of installation location, the post top mounting system shall provide 360° of rotational direction adjustment and upon installation, must be oriented with the collector facing South.

The solar panel must be IEC61215, TUV, and UL 1703 certified. The solar panel shall operate at 12VDC nominal with a maximum output rating of 85 watts.

All solar panel connectors shall conform to Ingress Protection, IP-67 rating, dust proof, and protected from temporary immersion in water up to 1 meter deep for 30 minutes. Connectors shall be Deutsch DTM series.

All solar panel fasteners shall be anti-vandal pin-type set screws. Wrench shall be provided.

610.40 – RRFB 105 AH BATTERY EACH

RRFB 105 Ah Battery shall be housed inside the RRFB Control Cabinet.

Shall be internally housed in its own IP67 type enclosure.

Shall be independently replaceable of other control panel components.

Shall be able to monitor internal temperature.

Shall operate between the temperatures of -40° to +176°F (-40° to +80°C).

610.45 – RRFB WIRELESS TRANSCEIVER EACH

Shall operate wirelessly at 900 Mhz, utilizing Frequency Hopping Spread Spectrum (FHSS) technology to minimize the effects of external RF interference.

Shall seamlessly integrate with the controller to ensure sequential activation of other radio-equipped devices in the system.

Shall include an integrated LCD and two user-interface buttons for setup and troubleshooting, including readouts of flash duration (timeout), battery conditions, and LED testing functionality.

Shall include two LED indicators for status and troubleshooting.

Shall be capable of operating as a Parent (Gateway) or Child (Node or Repeater).

Shall be capable of providing site-survey data for verification of signal strength between network devices.

Shall include network-wide modification of sign controller settings and output durations, using programmability from any networked transceiver without the use of additional equipment or software.

Shall have a nominal output voltage of 12 VDC and a capacity of 105Ah.

Shall be three quantity 12-volt 35Ah batteries connected in parallel and individually fused.

Shall be rechargeable type Absorbent Glass Mat.

Shall be sealed and spill-proof.

Battery shall be replaceable independently of other components.

Shall be fused for short-circuit protection.

610.50 – RRFB CROSSWALK ILLUMINATOR EACH

RRFB Crosswalk Illuminator shall operate in conjunction with the crosswalk controller and intelligent warning devices.

Shall activate when less than 10 lux of ambient light is present (when activated by a pedestrian).

Shall provide at least 20 vertical lux at 5 feet for a standard 2 lane crosswalk.

Shall activate with a .5 second soft start.

Shall allow for multiple brightness options for each of illuminator.

Shall be housed in its own IP66 type enclosure.

Shall be made of weather resistant materials (aluminum, stainless steel, plastic).

Shall be able to be adjusted and aimed both horizontally and vertically.

Shall be independently replaceable among other control panel components.

Shall operate between the temperatures of -40° to +176°F (-40° to +80°C).

610.55 – RRFB LIGHT BAR **EACH**

The RRFB-XL2™ Light Bar Or City Approved Equal shall be in conformance with all applicable FHWA MUTCD standards and guidelines, and shall meet or exceed the requirements specified in FHWA Memorandum IA-21, Interim Approval for Optional Use of Pedestrian-Actuated Rectangular Rapid Flashing Beacons at Uncontrolled Marked Crosswalks.

Shall house two rapidly and alternately flashing rectangular yellow LED array vehicle indications and one side-mounted yellow LED array pedestrian indication. The LED arrays shall be designed, located and operated in accordance with the detailed requirements as specified on the plans.

When activated, The Light Bar shall have 75 periods of flashing per minute and shall have alternating and simultaneous flash operations following the “WW+S” flash pattern.

Active vehicle indications shall be visible at distances over 1000 feet during the day and over one mile at night.

The light intensity of the vehicle indications shall meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005. Manufacturer Certification of Compliance shall be provided upon request.

Shall have a housing that is constructed of durable, corrosion-resistant powder-coated aluminum with stainless steel vandal-resistant fasteners.

Shall have enclosed components that are modular in design whereby any component can be easily replaced without having to uninstall the RRFB assembly.

Shall include mounting hardware for either single or back-to-back pole mounting and shall be universal to the pole type.

Shall have two vehicle RRFB indications that are approximately 7” wide x 2.8” high, each with 8 yellow LEDs in its array and one Pedestrian indication that is approximately 0.5” wide x 1.7” high with 8 individual yellow LEDs in its array.

Shall have overall dimensions of approximately 23.6” wide x 3.8” high x 1.4” deep.

610.60 – RRFB AUDIBLE PUSH BUTTON **EACH**

Shall be ADA compliant.

Shall function as a normally open (n/o) circuit with the following features:

Voice narration message with ambient adjustable volume control and field-replaceable speaker

Voice narration to be English and English/Spanish selectable

Programmable number of audible message repeats

Configurable Locator Tone

Ability to configure features using mobile application

Shall have a directional push button that can be rotated into a fixed position for the application.

Shall be provided with all necessary mounting hardware, wiring and associated ADA signage.

Shall have ambient noise detection configurable for auto volume control.

Shall have Bluetooth Low Energy (BLE) radio to provide optional wireless communication and configuration features.

Shall have an operating voltage range of 10-24 VDC.

Shall have an idle current of approximately 9 mA @ 12V.

Shall operate from -30° to +165°F (-34° to +74°C).

610.65 – RRFB PEDESTRIAN THERMAL SENSOR EACH

The pedestrian thermal sensor shall have an aluminum housing with sunshield and use infrared heat profiles to identify road users within detection zones and send actuation signals to pedestrian signal. Sensor shall integrate directly with RRFB assembly specified in Item 610.00.

Shall detect users located between zero and 82 feet from sensor.

Shall function reliably in dark, shadow, and sun glare conditions.

Shall be IP-67 rated and have an operating temperature between -40 degrees Fahrenheit and 131 degrees Fahrenheit.

Sensor shall function with between 12 V and 24 V DC, be configurable with Ethernet or Wi-Fi connections.

Shall include all cabling, mounting hardware brackets, and banding straps to needed for install and to provide functional detection at any pedestrian-signal location.

610.70 – RRFB STATIC SIGNS EACH

Each static sign face shall be constructed on a 0.080" thick 5052-H32 aluminum and screened onto 3M Diamond Grade DG^3 Reflective sheeting of specified color.

Shall have MUTCD-compliant sign legend, or as directed by the City.

Shall have two holes for mounting to a post or pole.

Shall include pole-mounting hardware.

610.80 – RRFB POLE AND BASE EACH

Pole shall be a standard specified outer diameter aluminum pedestal pole.

Pole shall be supplied with one end threaded for easy installation into a pedestal base.

Pole shall be Schedule 40 pipe raw aluminum as required.

Pedestal Base shall be TP-358 cast aluminum that mounts on a concrete foundation attached by four internal anchor bolts imbedded in the foundation.

Pedestal Base shall have a large 8.5" square hand hole cover allowing access to the interior.

611.00 – ACCESSIBLE PEDESTRIAN SIGNAL

General

Accessible pedestrian signal (APS) shall be ADA compliant and shall function as a normally open (n/o) circuit with the following features:

Voice narration message with ambient adjustable volume control and field replaceable speaker

Voice narration to be English and English/Spanish selectable

Programmable number of audible message repeats

Configurable Locator Tone

Configurable features through app

Ambient noise detection configurable for auto volume control

Bluetooth Low Energy (BLE) radio providing wireless communication and configuration functionality

Shall have an operating voltage range of 10-24 VDC.

APS shall have a directional push button that can be rotated into a fixed position for the application. APS shall be provided with all necessary mounting hardware, wiring, interconnect boards, SDLC cables, PC app dongle, and associated ADA signage.

APS shall have an idle current of approximately 9 mA @ 12V and operate from -30° to +165°F (-34° to +74°C).

611.10 – APS INTELLIGENT CENTRAL CONTROL UNIT (ICCU) EACH

APS Intelligent Central Control Unit (ICCU) shall be a Polara iCCU-S2 (or approved equivalent).

611.12 – APS PED HEAD CONTROL UNIT (IPHCU) EACH

APS Ped Head Control Unit (IPHCU) shall be a Polara iPHCU3S (or approved equivalent).

611.16 – APS PUSH BUTTON (2-WIRE) EACH

APS Push Button (2-Wire) shall be a Polara iNS2 (or approved equivalent).

611.18 – APS PUSH BUTTON (3-WIRE) EACH

APS Push Button (3-Wire) shall be a Polara iNS3 (or approved equivalent).

STANDARD SPECIFICATIONS

612.00 – TRAFFIC SIGNAL POSTS AND HARDWARE

General

Traffic signal and pedestrian posts shall be 4-inch aluminum pipe. Bottoms shall have 4-inch pipe threads. All signal posts shall have a Black powdered coat finish. All threads shall be protected during transportation.

All brackets shall be 1- 1/2" steel pipe with cast iron fittings painted Black. All pedestrian signal heads and traffic signal heads shall be attached to the traffic post with upper and lower assemblies with accessibility to the wiring without dissembling the hardware, unless attached directly onto the post top. All the traffic signal hardware material (T, elbows fittings, etc...) shall be cast iron, threaded at all openings, with set screws and painted Black.

Measurement and Payment

612.01 - Traffic Signal Poles-9 ft. Standard	each
612.10 - Aluminum Pole Plates for Side of Pole Mounting	each
612.20 - Iron Upper & Lower Pipe Assembly for Single Section Side of Pole Mounting-Complete	each
612.52 - Iron Support Nipple 1-1/2” x 3” – Threaded Both Ends	each
612.54 - Iron Slip “T” on Center Support – Threaded Both Ends w/Set Screws	each
612.55 - Support Tube, 1-1/2” NPS-Aluminum-19"-Powder Coat Black	each
612.56 - Support Tube, 1-1/2” NPS-Aluminum-43"-Powder Coat Black	each
612.57 - Support Tube, 1-1/2” NPS-Aluminum-57"-Powder Coat Black	each
612.60 - Steel Washers for Traffic Signals	each
612.70 – Slip Fitter Assembly for 3 and 4-Way Signal Heads – Threaded-Complete With Closure Cap, Serrated Lock Ring, and Zinc Oxide Locking Nut	each
612.71 – Zinc Oxide Nipple Locking Nut – 2 1/2"	each
612.72 – Neoprene Washers for Traffic Signals	each

612.73 – Serrated Locking Rings for Traffic Signals	each
612.74 – Threaded Octagon Signal Closure Closing Cap – 2" Length	each

614.00 - MAST ARMS, POSTS AND BASES

General

Mast arm bases shall be a permanent mold casting of 356-T4 aluminum alloys. The mast arm shaft shall be provided with an ornamental base similar to the Washington base style manufactured by Valmont Industries or similar to the Main Street Streetscape project. The use of adapter rings or clips is prohibited. The base height shall not exceed 45 inches. The base shall have a door opening and a door with a cap screw fastening device. A tapped hole shall be provided for a grounding lug. All bolts for holding hand hole and access covers shall be greased at the time of installation.

The anchor bolts shall be high strength (50,000 psi minimum yield strength). The anchor bolts shall be determined by the size of the mast arm but not less than I — h inches. All anchor bolts threads shall be greased prior to installing the base. Traffic signal posts shall not be erected on foundations until the concrete has set for a minimum of twenty - eight (28) days. Posts shall be set so that they are plumb prior to all loads applied.

Mast arms shall be a steel pole and be designed to accommodate fixed signals at the end and intermediate points as shown on the plans and designed to accommodate max loadings (Heavy Loads) and be designed to the latest MassDOT specifications. The mast arm lengths shall be as shown on the plans. Each member shall be spun from seamless tubing, ASTM- A36 alloy. Every arm shall have a high steel clamp set with minimum 5/8-inch neck bolts, or suitable means of attachment to mast arm shaft. A brushed wiring entrance hole shall be provided adjacent to the intermediate hanger. Every wiring entrance shall have a rubber grommet.

All mast-arm-mounted signal housings are to be fixed mounted using Astro-Brac or an approved equal mounting at the center of the housing. No Clevis pin brackets are to be used without approval from the City's Traffic Engineer. Signal heads shall be vertically fixed-mounted. All arms shall have a removable cap at the tip. Mounting hardware for side-of-shaft mounting shall be heavy-duty pole plates and couplings. The bottom of the signal heads shall have a minimum clearance of not less than 16 feet or greater than 19 feet above the pavement grade at the center of the roadway.

The signal head mounting system shall be detailed and submitted to the City's Traffic Engineer for approval. The final adjustment of the facing of the traffic signals shall be made as directed by the City's Traffic Engineer after all signals at the intersection are in operation. Exposed surfaces of the traffic signal post and bases shall have a Black polyester powder finish.

All mast arm posts shall be produced from one piece of seamless tubing, ASTM-A595 GR A Alloy, with a steel monotube (7GA .1793 inches) and be designed to the latest Section 800 of the MSSHB specifications. The shaft shall be tapered at .14 in/ft. The top 6 feet of the shaft shall be uniform. The pole shall have no visible longitudinal or circumferential welds except those joining the shaft at the base. The shaft shall have a J-hook wire support inside the pole near the top. Access from the top of the post must be available to run any wiring without disassembling the mast arm. The bottom of the pole shall have a 4"x 6" hand hole for access to wiring. Exposed surfaces of the traffic signal mast arm post and bases shall

have a Black polyester powder finish and tire wrapped with heavy, water-repellent paper for protection during shipping and installation.

The Contractor shall be responsible for making all necessary arrangements to have the proper utility companies relocate overhead wires for the proper mast arm clearances to be obtained, should any conflicts occur. The Contractor shall take extra care and precautions in placing signal heads to ensure the existing structures and overhead utility wires do not interfere with the visibility of the signal heads suspended above the roadway. All measurements to determine the exact dimensions and clearances between mast arms and existing structures and overhead utility lines shall be made in the field by the Contractor in the presence of the City's Traffic Engineer and incorporated into the erection plans and shop drawings which are submitted for approval.

All structures shall be constructed in accordance with the applicable requirements of the Section 800 of the MSSHB standard drawings. The completed structure with all appurtenances attached thereto shall be designed and constructed in accordance with the most current requirements of AASHTO Section 800 of the MSSHB Standard Specifications for Structural Supports for Highway signs, Luminaries and Traffic Signals (Current edition) for a wind speed of 130 miles per hour and a 30% Gust Factor with maximum loading. Longhand design calculations shall be submitted for all mast arm and span wire assemblies. All shop drawings and calculations shall be stamped by a professional structural engineer registered in the State of Massachusetts.

Measurement and Payment

614.15 - 15 ft. Mast Arm Assembly-Type II, Max (Heavy) Loadings	each
614.20 - 20 ft. Mast Arm Assembly-Type II, Max (Heavy) Loadings	each
614.25 - 25 ft. Mast Arm Assembly-Type II, Max (Heavy) Loadings	each
614.30 - 30 ft. Mast Arm Assembly-Type II, Max (Heavy) Loadings	each
614.35 - 35 ft. Mast Arm Assembly-Type II, Max (Heavy) Loadings	each
614.40 - 40 ft. Mast Arm Assembly-Type II, Max (Heavy) Loadings	each
614.45 - 45 ft. Mast Arm Assembly-Type II, Max (Heavy) Loadings	each
614.50 - Mast Arn Bases — Breakaway 20" bolt pattern on bottom (TB4)	each
614.60 - Mast Arm Ornamental Bases Only-Valmont Type	each
614.70 - Mast Arm Ornamental Bases Only -Union Metal Type	each
614.80 - Aluminum Octagonal Traffic Signal Base w/Threaded Steel Coupling (356 alloy/B-26, Black Powder Coat)	each

614.81 - Astro-Brac Galaxy 1-Way Assembly-120" Stainless Cable Mount-3 Section - Not Painted	each
614.82 - Astro-Brac Galaxy 1-Way Assembly-120" Stainless Cable Mount-4 Section - Not Painted	each
614.83 - Astro-Brac Galaxy-2-Way Assembly-120" Stainless Cable Mount-3 Section - Not Painted	each
614.84 - Astro-Brac - Gusseted Tube With Vinyl Insert 74" - Not Painted	each
614.89 - Opticom Band Mounting Hardware Kits for Mast Arms	each
614.91 - Rigid Mast Arm Hanger Body Assembly (SE-3056 or approved equivalent)	each
614.92 - Cast Iron Plumbizer Assembly	each
614.93 - Free-Swinging Mast Arm Hanger Assembly-Aluminum With Outlet Body and Cast Nipple-Complete (SE-3201 or approved equivalent)	each
614.94 - Rigid Mast Arm Hanger-2-Way-Aluminum 1-1/2" NPS Upper and Tri-Stud Lower (SE-3346 or approved equivalent)	each

616.00 - LED - RED, GREEN, AND AMBER INDICATIONS

General

An independent laboratory shall certify that all LED signal modules comply with Section 6 Quality Assurance of the ITE's Publication ST-021 and approved as an Energy Star Partner.

LED traffic signal modules shall be designed as replacements for existing signal lamps. LED signal modules shall fit into existing traffic signal housings built to the Institute of Transportation Engineers (ITE) publication ST-017B "Vehicle Traffic Control Signal Heads" standard (referred to in this document as "VTCSH") without any modification to the existing housing. Installation of the LED module into an existing signal housing shall only require removal of the existing lens and incandescent bulb, fitting of the LED module unit securely in the housing door, and connecting to existing electrical wiring or terminal block by means of simple connectors. All LED modules shall be standard 12-inch lenses.

On the backside of the LED signal module there shall be a permanently marked "up" arrow to aid in proper orientation of the module for installation.

The manufacturer's name, trademark, serial number and other necessary identification shall be permanently marked on the backside of the LED signal module.

Physical and Mechanical Requirements

The LED signal module shall be a single, self-contained device, not requiring on-site assembly for installing into an existing traffic signal housing. This device shall conform to ASTM specifications for materials used in the construction of the LED signal module.

The assembly and manufacturing process for the LED signal assembly shall be as such to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. Enclosures containing the power electronic components of the signal module shall be made of flame retardant materials that will self-contain internal sparks and flames, as well as dripping materials.

Each LED signal module shell shall be comprised of a smooth surface stabilized polycarbonate outer shell, multiple LED light sources, a regulated power supply, and a polycarbonate back cover assembled in a silicon sealed unit. LEDs are to be mounted on a polycarbonate positioning plate. Each LED signal module shall have a beveled outer shell. A mechanical alignment and assembly mechanism must ensure that each LED should be maximized by an internal beam-controlling optical-faceted lens.

At time of installation, the legs of LEDs (heat dissipaters) should be kept at full length to improve heat dissipation from LEDs. The replacement of one or more LEDs as well as the replacement of one or more LED circuits must be possible without desoldering or soldering.

Optical and Light Output Requirements

The minimum luminous intensity values and light output distribution shall be shown in Section 11.04 and Table I of the VTCSH Standard.

The minimum luminous intensity values and light output shall be maintained within the input voltage range of 90 to 120 volts. LED signal modules shall not be allowed to fall short of the minimum intensity values at any of the 44 measuring points of the standard when lamp is turned on cold for measurements and after a 30-minute warmup period at 100% duty cycle.

An LED traffic signal module shall not exhibit more than a nominal -l change in luminous intensity per a +1 degree Celsius change in ambient temperature.

The colors of the LED signal modules shall conform to chromaticity requirements of Section 8.04 and Figure 1 of the VTCSH standard.

Electrical

All wiring and terminal blocks shall meet the requirements of Section 13.02 of the VTCSH standard.

Two captive, 2-colored coded, 900 mm long, 600 volt, #18 AWG minimum, jacketed wires, conforming to the National Electric Code, rated for a service at 105 degrees Celsius, are to be provided for electrical connection.

Each module shall incorporate a regulated power supply engineered to electrically protect the LED's and maintain a safe reliable operation. The power supply shall provide capacitor filtered DC regulated current to the LED's as per the LED's manufacturer's specification. The module shall meet UL No. 1012 and/or CSA C22 No. 205 standards.

The LED signal module shall operate off a 60 Hz AC line voltage ranging from 90 Volts rms to 135 Volts rms. Nominal rated voltage for all measurements shall be 117 Volts rms. The circuitry shall prevent flicker over this voltage range. The circuitry shall prevent flicker at all voltages below 90 Volts rms for a minimum time period of 16 milliseconds.

The signal module on-board circuitry shall include voltage surge protection to withstand a single peak transient of 600 Volts of each polarity for 100 ms duration. The LED signal and associated on-board

circuitry must meet or exceed Federal Communications Commission (FCC) Part 15 regulations concerning the emission of electronic noise.

The individual LED light sources shall be wired so that a catastrophic failure of one LED light source will not result in the loss of illumination in more than 20 percent of the LED light sources.

The LED signal module shall be compatible with currently-used controllers and conflict monitors. The LED signal circuitry shall prevent false controller conflict monitor action due to excessively high off-state input impedance.

Maximum wattage for 300 mm red ball shall be 20 Watts and 8 Watts for 300 mm red arrow.

Environmental Requirements

The LED signal module shall be rated for use in the ambient operating temperature range of 35 degrees Celsius to 75 degrees Celsius.

The LED signal module shall be dust and moisture tight to prevent all internal LED and electrical components.

The LED signal module shall be capable of withstanding exposure to an environment of 74 degrees Celsius - 95% relative humidity for 168 hours without internal condensing moisture. The lens of the LED signal module shall be capable of withstanding ultraviolet (direct sunlight) exposure for a minimum time period of five (5) years without exhibiting evidence of deterioration.

Warranty

The LED signal module will be replaced or repaired by the manufacturer if it exhibits a failure due to workmanship or materials defects within the first 60 months of field operation.

The LED signal module will be replaced or repaired by the manufacturer if it exhibits either a greater than 50% light output degradation or fall below the minimum intensity levels within the first 36 months of field operation.

Measurement and Payment

616.00 - 12" Red LED Ball Indication	each
616.10 - 12" Red LED Arrow Indication	each
616.20 - 12" Red LED for 3M Programmable signals	each
616.30 - 12" Green LED Ball Indication	each
616.40 - 12" Green LED Arrow Indication	each
616.50 - 12" Green LED For 3M Programmable Signals	each
616.60 - 12" Amber LED Ball Indication	each
616.70 - 12" Amber LED Arrow Indication	each
616.80 - 12" Amber LED for 3M Programmable Signals	each

618.00 – FIBER OPTIC INTERCONNECT CABLE (MASTER TO LOCALS) OR (LOCALS TO LOCALS) LINEAR FOOT

General

Work under this item consists of furnishing all materials, equipment, appurtenances and making electrical connections for interconnecting traffic signal controllers to the On-Street Master. The installation shall be performed by others in conformance with the applicable provisions of Section 800.

The interconnect fiber optic cable shall be 12-strand singlemode, outside plant, loose tube. The cable shall utilize a single layer polypropylene tube and shall use super absorbent polyester tape in place of gel for water blocking. The pair shall meet or exceed the following requirements:

Each controller cabinet shall contain a distribution panel Fibertron FTW024 or equal. All fibers shall be terminated at distribution panel in each cabinet, using ST connectors.

The total length shall not exceed six (6) miles.

Impedance of 600 ohms resistive and balanced.

Envelope delay distortion shall be less than 1750 microseconds in the band from 800 to 2600 Hz.

Frequency response referred to 1000 Hz from 300 to 3000 Hz shall be flat-3, +12 dB. Response reference to 1000 Hz from 500 to 250 Hz shall be flat-2, +8 dB.

Insulation between any conductor and ground shall be at least 20 megohms DC and 50 kiloohms AC from 300 to 3000 Hz.

Capable of transmitting a signal of not less than +10 dBm (average).

Noise level shall be no more than -62 dBm.

Non-linear (harmonic distortion, fundamental to first harmonic of 25 dB minimum, fundamental to third harmonic of 30 dB minimum.

Breakdown between any conductor and ground shall be greater than 1500V rms at 60Hz.

Minimum receiving level at most distant point shall be no less than -16 dBm at O dBm input power.

BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
601.00	**Controller-TS 2 Type 2**	**each**	**15**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
601.10	**Controller Wiring Harness**	**each**	**5**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.00	**Controller Cabinet Assembly-Type P-Per Spec**	**lump sum**	**3**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.05	**Controller Cabinet Shell Only, Type P**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.10	**Controller Cabinet Assembly-Type M-Per Spec**	**lump sum**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

Note: Specifications for the signal equipment are listed in previous section. All traffic signal equipment must comply with the Manual on Uniform Traffic Control Devices (MUTCD) specifications and be on the MassDOT Qualified Traffic Control Equipment list (QTCE). The quantities shown above are estimated only. The Bidder will be required to furnish all quantities ordered by the City during the period of the contract. Bidder must state and clearly identify the product offered, such as manufacturer's name, trade name, brand name and quality next to each item. All bidders shall supply catalog cut sheets for all equipment listed. Failure to do so may result in the rejection of any and all parts of the bid. **The City reserves the right to increase or decrease the quantities ordered.**

BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
602.15	**Controller Cabinet Shell Only, Type M**	**each**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.50	**MMU2-16LEIP Series Management Malfunction Unit**	**each**	**20**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.81	**Opticom 2-Channel Phase Selectors (700 series)**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.82	**Opticom 4-Channel Phase Selectors (700 series)**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.83	**White Conformation Strobe Indicator for Preemption**	**each**	**10**	

Bidder Name: _____

Note: Specifications for the signal equipment are listed in previous section. All traffic signal equipment must comply with the Manual on Uniform Traffic Control Devices (MUTCD) specifications and be on the MassDOT Qualified Traffic Control Equipment list (QTCE). The quantities shown above are estimated only. The Bidder will be required to furnish all quantities ordered by the City during the period of the contract. Bidder must state and clearly identify the product offered, such as manufacturer's name, trade name, brand name and quality next to each item. All bidders shall supply catalog cut sheets for all equipment listed. Failure to do so may result in the rejection of any and all parts of the bid. **The City reserves the right to increase or decrease the quantities ordered.**

BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.84	**Opticom Detector (700 series) — One-Way Direction**	**each**	**16**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
602.85	**Opticom Detector (700 series) — Two-Way Direction**	**each**	**8**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
603.70	**24V 5A shelf Mount Power Supply for TS-2 Cabinet**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

Note: Specifications for the signal equipment are listed in previous section. All traffic signal equipment must comply with the Manual on Uniform Traffic Control Devices (MUTCD) specifications and be on the MassDOT Qualified Traffic Control Equipment list (QTCE). The quantities shown above are estimated only. The Bidder will be required to furnish all quantities ordered by the City during the period of the contract. Bidder must state and clearly identify the product offered, such as manufacturer's name, trade name, brand name and quality next to each item. All bidders shall supply catalog cut sheets for all equipment listed. Failure to do so may result in the rejection of any and all parts of the bid. **The City reserves the right to increase or decrease the quantities ordered.**

BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
603.75	**16-Channel 10-POS Detector Rack w/Opticom Compatibility**	**each**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
604.00	**Video Detection-Complete System**	**lump sum**	**3**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
604.02	**16 Channel TS 2 Cabinet Detector Rack With BIU**	**each**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
604.05	**WDR Video Detection Camera with Mounting Hardware**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

Note: Specifications for the signal equipment are listed in previous section. All traffic signal equipment must comply with the Manual on Uniform Traffic Control Devices (MUTCD) specifications and be on the MassDOT Qualified Traffic Control Equipment list (QTCE). The quantities shown above are estimated only. The Bidder will be required to furnish all quantities ordered by the City during the period of the contract. Bidder must state and clearly identify the product offered, such as manufacturer's name, trade name, brand name and quality next to each item. All bidders shall supply catalog cut sheets for all equipment listed. Failure to do so may result in the rejection of any and all parts of the bid. **The City reserves the right to increase or decrease the quantities ordered.**

BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
604.07	**Video Detection Camera With Radar And Mounting Hardware**	**each**	**4**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
604.08	**Video Detection Camera Surge Protection Panel**	**each**	**5**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
604.10	**Rack-Mount Video Detection Processor (4-Channel)**	**each**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
604.60	**Galaxy Camera Bracket w/74" Gusseted Tube, Vinyl Insert, and Detector Mounting Hardware**	**each**	**25**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
605.10	**Central Control Unit (1-U Rack Mount)**	**each**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
605.20	**Central Control Unit (Shelf-Mounted; TS 1) With Power Supply**	**each**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
605.30	**Central Control Unit (Shelf-Mounted; TS2-Four Sensor) With Power Supply**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
605.30a	**Central Control Unit (Shelf-Mounted; TS2-Eight Sensor) With Power Supply**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
607.10	**CAT5e Direct Burial Shielded Cable (1000 ft)**	**each**	**5**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
607.15	**CAT5e Shielded Pass Through RJ45 Connectors (100-pack)**	**each**	**3**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
608.20	**12" Tunnel Visor for Traffic Signal**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
609.01	**16" Countdown LED Pedestrian Signal Heads w/Visors-Complete**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
609.10	**16" Countdown LED Pedestrian Modules**	**each**	**100**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
609.30	**16" Open Pedestrian Visors**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.00	**Rectangular Rapid Flashing Beacon Assembly**	**lump sum**	**30**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.10	**RRFB Control Cabinet**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.20	**RRFB Controller**	**each**	**5**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
610.30	**RRFB Solar Charge Controller**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.35	**RRFB 115-Watt Solar Panel**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.40	**RRFB 105 Ah Battery**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.45	**RRFB Wireless Transceiver**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.50	**RRFB Crosswalk Illuminator**	**each**	**2**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
610.55	**RRFB Light Bar**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.60	**RRFB Audible Push Button**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
610.80	**RRFB Pole and Base**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
611.10	**APS Intelligent Central Control Unit (ICCU)**	**each**	**1**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
611.12	**APS Ped Head Control Unit (IPHCU)**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
611.16	**APS Push Button (2-Wire)**	**each**	**8**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
611.18	**APS Push Button (3-Wire)**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
612.01	**Traffic Signal Poles-9 ft. Standard**	**each**	**25**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
614.50	**Mast Arm Bases —Breakaway 20" bolt pattern on bottom (TB4)**	**each**	**25**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
614.60	**Mast Arm Ornamental Bases Only-Valmont Type**	**each**	**5**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
614.70	**Mast Arm Ornamental Bases Only -Union Metal Type**	**each**	**5**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
614.80	**Aluminum Octagonal Traffic Signal Base w/Threaded Steel Coupling (356 alloy/B-26, Black Powder Coat)**	**each**	**25**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
614.89	**Opticom Band Mounting Hardware Kits for Mast Arms**	**each**	**30**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
614.91	**Rigid Mast Arm Hanger Body Assembly (SE-3056 or approved equivalent)**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
616.00	**12" Red LED Ball Indication**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
616.10	**12" Red LED Arrow Indication**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
616.20	**12" Red LED for 3M Programmable signals**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
616.30	**12" Green LED Ball Indication**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
616.40	**12" Green LED Arrow Indication**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

Bidder Name: _____

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BID PRICING SHEETS - CR-8611-J6

Item Number	Item Description <Unit Bid Price-Written>	Unit <Manufacturer>	Estimated Qty <Model>	Unit Price <Value>
616.50	**12" Green LED For 3M Programmable Signals**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
616.60	**12" Amber LED Ball Indication**	**each**	**50**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
616.70	**12" Amber LED Arrow Indication**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each
616.80	**12" Amber LED for 3M Programmable Signals**	**each**	**10**	
	_____ Per Each	_____ Manufacturer	_____ Model	$_____ Each

****All materials, supplies, parts, etc. not specifically listed above, but included in our specifications may be procured, at the discretion of the City, by the Contractor and charged to the City of Worcester at a rate not to exceed 10% over the Contractor's net cost. The City may request original copies of the Contractor invoices at any time to confirm said costs.**

Bidder Name: _____

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