TOWN OF BURLINGTON
DEPARTMENT OF PUBLIC WORKS

TRAFFIC SIGNAL
IMPROVEMENT PROJECT

BEDFORD ST (ROUTE 62)
AT
MIDDLESEX TURNPIKE EXT.

Contract #18C-411-0015

This is an unofficial Bid Spec. If this document is used to submit a bid then you must email your contact information to Engineering@burlington.org in order to be added to the bidders list.

Department of Public Works
25 Center Street
Burlington MA 01803

February 2018
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INVITATION FOR BID

PUBLIC WORKS CONSTRUCTION

Sealed bids for TRAFFIC SIGNAL IMPROVEMENT PROJECT – BEDFORD ST (ROUTE 62) AT MIDDLESEX TURNPIKE EXT. must be received by Department of Public Works, Town Hall Annex, 25 Center Street, Burlington, Massachusetts, 01803 until **10:00AM, February 22, 2018** and will be publicly opened and read aloud at such time.

- Specifications and bid forms are available on the Town of Burlington website site at: [http://www.burlington.org](http://www.burlington.org) under the “Business” drop-down menu.
- Specifications and bid forms may be obtained at the DPW/Engineering Division, Town Hall Annex, 25 Center Street, Burlington, Massachusetts, 01803 on and after February 8, 2018 between 8:30 AM and 4:00 PM for a fifty ($50.00) dollar non-refundable reproduction cost.
- A bid bond of five (5) percent is required.
- Successful bidder must provide 100% Payment and Performance bonds.
- This project is bid according to MGL 30-39M.
- Town’s Designated Representative and point of contact for questions is: Brian White, bwhite@burlington.org, 781-505-1116.
- Prevailing wage must be paid per MGL 149 SECT. 26-27D
PROJECT DESCRIPTION

The work under this Contract consists of reconstruction of the traffic signal at the intersection of Bedford Street (Route 62) at Middlesex Turnpike Extension.

The work includes unclassified excavation, conduit, pull boxes, signs, new traffic signal system, and all other equipment, labor, material, supplies, etc. necessary to furnish the work described in this contract.
INSTRUCTIONS TO BIDDERS

Receipt and Opening of Bids
The Town of Burlington, Massachusetts, herein called the Owner, acting by and through its Department of Public Works, will receive sealed bids as specified in the invitation for Bids at which time bids will be publicly opened and read.

Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified will not be considered. The bidder agrees that this bid will be good and may not be withdrawn for a period of thirty (30) days, Saturdays, Sundays, and legal holidays excluded, after opening the bids.

Location and Work to be Done
The Location of the work to be done is described in the project description.

The Contractor will furnish all labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, and all other things necessary to do all work required for the completion of each item of the work and as herein specified.

The work to be done and paid for under any item will not be limited to the exact extent mentioned or described but will include all incidental work necessary or customarily done for the completion of that item.

Preparation of Bid
Each bid must be submitted on the prescribed form. All blank spaces for bid prices must be filled in, in ink or typewritten, in both words and figures.

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his address, and endorsed with the name of the project as specified in Receipt and Opening of Bids.

If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in Receipt and Opening of Bids.

The following sections need to be filled out and completed as part of the bid package;
- Form of General Bid
- Acknowledgement of Addenda, if any
- Bid Form
- Total Bid Price
- Contractor Reference
- Contractor Certification

Bid Opening Procedure
The following list of requirements will apply to each filed bid. Bids not meeting all the requirements for timeliness and security will be rejected without opening; bids not meeting signature and addenda requirements will be rejected prior to checking of bid amounts.

Bids will be filed at the place and before the time specified in Receipt and Opening of Bids.

Properly executed bid security will be placed in a sealed envelope and will be attached to the outside of the envelope containing the bid.

Bid signatures will be checked.

The total dollar amount of each bid will be read, and the three apparent lowest bids will be selected for further consideration. These three apparent low bids will be read aloud for the benefit of the other bidders and the bid opening procedure will be closed. All those present at the bid opening may arrange a time to examine all bids after the bid opening and after the reading of the three apparent low bids.

**Ability and Experience of Bidder**

No award will be made to any bidder who cannot satisfy the Owner that he has sufficient ability and experience in this class of work and sufficient capital and resources to enable him to complete the work successfully within the time named. The Owner’s decision or judgment on these matters will be final, conclusive, and binding.

**Bidder must have a minimum of five (5) years’ experience and have completed satisfactorily five (5) jobs within that time of similar size and scope.**

**All Subcontractors must have a minimum of five (5) years’ experience and have completed satisfactorily five (5) jobs within that time of similar size and scope.**

The Contractor must submit with his bid proposal a list of five (5) jobs which he has successfully completed, giving the name and the address of these projects so they can be investigated prior to the award of the contract.

The Owner may make such investigations as he deems necessary, and the bidder must furnish to the Owner, under oath if so required, all such information and data for this purpose as the Owner may request.

**Condition of Work**

Each bidder must familiarize himself fully with the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provisions of this Contract. Insofar as possible the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor.
Addenda and Interpretations
No interpretation of the bid documents will be made orally. Every request for such interpretation should be in writing addressed to the Town’s Designated Representative listed in INVITATION TO BID and to be given consideration must be received at least seven (7) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Contract Documents. Failure of any bidder to receive any such addendum or interpretation will not relieve such bidder from any obligation under this bid as submitted. All addenda so issued will become part of the Contract Documents.

Laws and Regulations
The bidder’s attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulation of all authorities having jurisdiction over construction of the project will apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

Bid Security
Each bid must be accompanied by a BID BOND, CASH, or, CERTIFIED CHECK, payable to the Town, in the amount stated in INVITATION FOR BID. Such checks will be returned to all except the three (3) lowest responsible and eligible bidders within five (5) days, Saturday, Sundays, and legal holidays excluded, after the opening of bids, and the remaining checks will be returned promptly after the Owner and the accepted bidder have executed the Contract, or if no notice of intent to award has been presented to the selected contractor within thirty (30) days, Saturdays, Sundays and holidays excluded, after the date of the opening of bids, upon demand of the bidder at any time thereafter.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount will be retained from time to time by the Owner from current periodical estimates.

Right to Reject Bid
The Owner reserves the right to waive any informality or reject any and all bids and alternate bids, should the Owner deem it to be in the public interest to do so.

The Owner also reserves the right to reject the bid of any bidder that the Owner considers to be unqualified based on the criteria set forth herein.

Time for Completion
The bidder must agree to commence work and to fully complete the project within the time limit stated in SPECIAL CONDITIONS.

Comparison of Bids
In the event that there is a discrepancy in FORM OF GENERAL BID between the lump sum or unit prices written in words and figures, the prices written in words will govern.

**Rule for Award of Contract**

The Contract will be awarded to “the lowest responsible and eligible bidder” for the Total Price Bid pursuant to General Laws Chapter 30, Section 39M, as amended. Such a bidder will possess the skill ability and integrity necessary for the faithful performance of the work, will be able to furnish labor that can work in harmony with all other elements of labor employed, or to be employed, in the work, and will otherwise comply with all applicable provisions of law. Bidder will execute formal agreement within ten (10) days of the Notice of Award.

**Statutes Regulating Competitive Bidding**

Any bid that does not comply with the provisions of Massachusetts General Laws Chapter 30, Section 39M as amended, need not be accepted and the Owner may reject every such bid.

**Wage Rates**

Prevailing Wage Rates as determined by the Commissioner of Department of Labor and Industries under the provision of the Massachusetts General Laws, Chapter 149, Section 26 to 27G, as amended, apply to this project. It is the responsibility of the contractor, before bid opening to request if necessary, any additional information on Prevailing Wage Rates for those trades people who may be employed for the proposed work under this contract.

State schedules of Prevailing Wage Rates are included in the contract documents.

**Specifications**

All work under this Contract must be done in conformance with the Standard Specifications for Highways and Bridges dated 1988, as amended, the Supplemental Specifications dated July 1, 2015, as amended, the 2016 Construction Standard Details, the 1990 Standard Drawings for Signs and Supports, the 1996 Construction and Traffic Standard Details, the 2015 Overhead Signal Structure and Foundation Standard Drawings, the 2009 Manual on Uniform Traffic Control Devices (MUTCD) with Massachusetts Amendments, the 1968 Standard Drawings for Traffic Signals and Highway Lighting, the Plans and these Special Provisions.

The General Conditions, Supplementary Conditions and Special Provisions take precedence over the General Requirements of Division I of the Standard Specifications.

**Bid Items Not Guaranteed**

The successful bidder is not guaranteed all items or the total bid price under this contract. Bidders must understand that like items may be bid under other contracts specifically packaged as one complete project. The successful bidder has no right to similar items bid under other projects. The Owner will specify where and when this contract will be applied to undertake a particular improvement.
Liquid Asphalt Adjustment

Per MGL 30-38A paving or Hot Mix Asphalt items bid under this contract (if any) as subject to liquid asphalt price adjustment.
FORM OF GENERAL BID

Bid of ________________________________ (hereinafter called “Bidder”)*

(____) a corporation, organized and existing under the laws of the state of ___________.

(____) a partnership

(____) a joint venture

(____) an individual doing business as ________________________________

To the Town of Burlington, Massachusetts (hereinafter called “Owner”).

Gentlemen:

The bidder, in compliance with your invitation for bid, examined the Contract Documents and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby propose to furnish all labor, materials, and supplies, and to construct the project in accordance with the Contract Documents within the time set forth in the agreement, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, or which this proposal is a part.

----------------------

*Insert corporation, partnership or individual as applicable.
ADDENDA

Bidder acknowledges receipt of the following addenda:

No.______________________ Dated:______________________

No.______________________ Dated:______________________

No.______________________ Dated:______________________

No.______________________ Dated:______________________

No.______________________ Dated:______________________
BID FORM

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Qty</th>
<th>Item Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Signal</td>
<td>LS</td>
<td>$</td>
<td>1</td>
<td>$</td>
</tr>
<tr>
<td>Reconstruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TOTAL BID PRICE

Total Price Bid: $ ________________________________

Bid Price in Words: __________________________________

Name: _______________________________________

Signature: _______________________________________

Title: _______________________________________

Company: _______________________________________

Address: _______________________________________

Phone: _______________________________________

This is an unofficial Bid Spec. If this document is used to submit a bid then you must email your contact information to Engineering@burlington.org in order to be added to the bidders list.
CONTRACTOR REFERENCES

The undersigned offers the following information as evidence of his qualifications to perform the work as bid upon according to all the requirements of the plans and specifications.

1. Have been in business under present name for ___ years.

2. The names and addresses of all persons interested in the bid (if made by a partnership or corporation) as Principals are as follows:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(Attach supplementary list if necessary)

3. The bidder is requested to state below what work of a similar character to that included in the proposed contract he has done, and give references that will enable the Owner to judge his experience, skill and business standing (add supplementary page if necessary).

<table>
<thead>
<tr>
<th>#</th>
<th>Completion Date</th>
<th>Project Name</th>
<th>Contract Amount</th>
<th>Reference Name</th>
<th>Telephone No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>2</td>
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<td>5</td>
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</tr>
</tbody>
</table>

4. Bank reference ____________________________  
   (Name)  
   ____________________________  
   (Bank)  
   ____________________________  
   (Address)  
   (Telephone No.)
CONTRACTOR CERTIFICATION

NON-COLLUSION

I certify under penalties of perjury that this bid or proposal has been made and submitted under good faith and without collusion or fraud with any other person. As used in this certification, the word “person” means any natural person, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals.

TAX COMPLIANCE

Pursuant to Massachusetts General Law Chapter 62C, Section 49A, I certify under the penalties of perjury that, to the best of my knowledge and belief, I am in compliance with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

LABOR HARMONY / OSHA 10-HOUR

I will furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work, and All employees to be employed in the work subject to this bid have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health administration that is at least 10 hours in duration.

Signature: __________________________________________________________
(Person Signing Bid)

___________________________________________________________________
(Name of Business)
AGREEMENT

THIS AGREEMENT, by and between the party of the first part, the Town of Burlington, hereinafter called “OWNER”, acting herein through its Town Administrator, and the party of the second part hereinafter called “CONTRACTOR”.

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the OWNER, the CONTRACTOR hereby agrees with the OWNER to commence and complete the project described by these bid documents hereinafter called the project, for the sum of the contract price and all extra work in connection therewith, under the terms as stated in the Contract Documents; and at his (its and their) own proper cost and expense to furnish all the materials, supplies, machinery equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said project in accordance with the conditions and prices stated in FORM OF GENERAL BID, GENERAL CONDITIONS, Contract Documents as prepared by the Owner.

IN WITNESS WHEREOF, the parties to these presents have executed this contract.

$ __________________________________________________________________________

Contract Price

AGREED:

Town of Burlington

_________________________  ___________________________
Owner                        Date

Contractor

_________________________  ___________________________
Contractor                  Date

Company Name: _______________________________________________________________________

Address: ___________________________________________________________________________

In accordance with M.G.L. C. 44, Section 31C, this is to certify than an appropriation in the amount of this contract is available therefore and that the Town Administrator has been authorized to execute the contract and approve all requisitions and change orders.

_________________________  ___________________________
Account #        Town Accountant  Date
SPECIAL CONDITIONS

1. All work under this Contract will comply with the most recent edition of the Town of Burlington Department of Public Works; Street Opening/Utility Connection Rules & Regulations.

2. Ability/Experience: The successful bidder will provide proof of all licenses, where applicable, and have the following criteria:
   - This Contract will be awarded only to a Contractor who is presently and primarily engaged in the business of maintaining, servicing, or installing traffic control signals and devices.
   - Bidder will have a minimum of five (5) years of experience and have satisfactorily completed five (5) jobs within that time of similar size and scope.
   - Bidder will have at least two (2) full time employees that have a minimum of ten (10) years of experience maintaining or installing traffic signal field equipment.
   - Bidder will have at least two (2) full time MassachusettsLicensed Electricians employed.
   - Bidder will have at least two (2) full time employees that are IMSA signal Technicians Level II.

3. Prior to the commencement of any work the Contractor must obtain a Street Opening permit from the DPW/Engineering Division.

4. The payment clauses contained in the Massachusetts Highway Department Standard Specifications do not apply to this Contract.

5. This work is bid on a lump sum basis. The Contract lump sum price will include all labor, materials, equipment and incidental costs required to complete this work, except for police services. The cost of police detail officer(s) will be paid for by the Town of Burlington.

6. After installation of new gate boxes, pull boxes, and structures, or adjustment of existing gate boxes, pull boxes, and structures, all construction debris will be removed providing easy access if need arises. All work and labor needed to furnish and remove the construction debris out of the infrastructure will be considered incidental to the Contract price.

7. All excavations in existing asphalt and cement concrete surfaces must be saw-cut.

8. All excavations in existing roadways must be backfilled with excavatable controlled density fill (CDF).
9. The Contractor must submit a Schedule of Values in order to request and receive progress payments under the lump sum bid item. In addition, each request for a progress payment must include the list of Schedule of Values stating which items have been complete and the associated quantities of each item.

10. All certified payroll slips must be submitted as part of the pay requisition package for each individual pay requisition request, for each Contractor and Subcontractor that has performed work under this contract, up to date of the current pay requisition before the pay requisition will be processed and paid.

11. Under this Contract the Contractor agrees to complete “Punch List of Items” assembled by the Designated Representative. The “Punch List of Items” are required to be completed before the final payment requisition is processed.

12. Written notice must be given by the Contractor to all public service corporations or municipal and State officials owning or having charge of publicly or privately owned utilities at least one week in advance of the commencement of operations that will affect the utilities. The Contractor will, at the same time, file a copy of such notice with the Owner.

13. Traffic Management under this contract must be considered at all times meaning the following points apply:
   - Two (2) way traffic must be maintained at all times.
   - Complete compliance with the Traffic Management Plan standards set forth in the Town of Burlington Department of Public Works Street Opening/Utility Connections Rules & Regulations
   - Detours not included as part of the Traffic Management Plan will be allowed only upon written authorization from the Owner. The Contractor is responsible for supplying all necessary sign(s) and traffic barrels necessary to attach the signs for the detour.
   - Work that will disrupt travel on the existing roadways (lane closures, lane shifts, trenching, etc.) will only be allowed between the hours of 9:00AM and 3:00PM unless prior approval by the Owner is given.
   - The Contractor must provide necessary access for fire apparatus and other emergency vehicles through the work zones at all times.
   - The Contractor must provide safe and ready means of ingress and egress to all stores and shops, public and private professional offices and any other businesses or residences in the project area, both day and night, for the duration of the project.

14. No work will be allowed on Saturdays, Sundays, or holidays without prior approval by the Owner.
15. The Contractor understands that the roadways and sidewalks in the locus area of this Contract will be reconstructed as part of another contract starting June 1, 2018. On and after this date, the Contractor is required to coordinate with any, and all, parties responsible for the roadway and sidewalk reconstruction project. The Contractor is required to reschedule any conflicting scheduled work to accommodate the roadway and sidewalk reconstruction project. This condition is considered incidental to the Contract cost.

16. All roadway and sidewalk excavations are required to be complete and fully restored by May 31, 2018. Failure to meet this condition will result in assessed liquidated damages in the amount of $1,000 per calendar day that this condition is not satisfied after this date.

Attention is directed to the following parts of the contract:

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<th>Location in Contract</th>
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<td>Instructions to Bidders</td>
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<tr>
<td>Experience of Bidders</td>
<td>Instructions to Bidders</td>
</tr>
<tr>
<td>Bid Security</td>
<td>Instructions to Bidders</td>
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<td>Execution, Correlation and Intent</td>
<td>General Conditions; Article 1</td>
</tr>
<tr>
<td>Contract Administration</td>
<td>General Conditions; Article 2</td>
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<td>Superintendent</td>
<td>General Conditions; Article 4, Section 8</td>
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<tr>
<td>Project/Progress Schedule</td>
<td>General Conditions; Article 4, Section 9</td>
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<tr>
<td>Liquidated Damages</td>
<td>General Conditions; Article 6</td>
</tr>
<tr>
<td>Prevailing Wage Rates</td>
<td>Appendix A</td>
</tr>
<tr>
<td>Project Plans</td>
<td>Appendix B</td>
</tr>
</tbody>
</table>

17. Summary Table of Important Contract Dates

<table>
<thead>
<tr>
<th>Item</th>
<th>Date</th>
<th>Liquidated Damages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid Opening</td>
<td>February 22, 2018</td>
<td>N/A</td>
</tr>
<tr>
<td>Commencement of Work No Later Than</td>
<td>10 days following receipt of Notice to Proceed</td>
<td>N/A</td>
</tr>
<tr>
<td>Completion of Work (Roadway and Sidewalk Excavations and Restorations) No Later Than</td>
<td>May 31, 2018</td>
<td>$1,000 per calendar day not in compliance after this date</td>
</tr>
<tr>
<td>Completion of Work (All Work in Entirety) No Later Than</td>
<td>July 31, 2018</td>
<td>$1,000 per calendar day not in compliance after this date</td>
</tr>
</tbody>
</table>
GENERAL CONDITIONS

ARTICLE 1

CONTRACT DOCUMENTS

1.1 DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS
The Contract Documents consist of the Owner-Contractor Agreement, the Conditions of the Contract (General, and other Conditions), the Drawings, the Specifications, all Addenda issued prior to and all Change Orders issued after execution of the Contract, and all applicable laws, ordinances and regulations. The Contract Documents include Bidding Documents such as the Advertisement or Invitation for Bid, the Instructions to Bidders, sample forms, the Contractor’s Bid or portions of Addenda relating to any of these, or any other documents, specifically enumerated in the Owner-Contractor Agreement.

1.1.2 THE CONTRACT
The Contract Documents form the Contract for Construction. This Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a written Change Order.

1.1.3 THE WORK
The Work comprises the completed construction required by the Contract Documents and includes all labor necessary to produce such construction, and all materials and equipment incorporated in such construction.

1.1.4 THE PROJECT
The project is the total construction of which the Work performed under the Contract Documents may be the whole or a part.

1.1.5 OR EQUAL
The use of the words “Or Equal” following the name of any manufacturer, vendor or proprietary product will be understood to mean that articles or materials may be substituted which, in the opinion of the Owner, are equal in quality, durability, appearance, strength, design and performance to the articles or materials named or described and will perform adequately in providing a first-class facility.

When submitting shop drawing information on articles or materials which are being proposed as substitutes for specified items, the Contractor must clearly identify them as such. If the articles or materials are accepted as equal to those on which dimensions on the drawings are based, any dimensional variance from those shown and/or specified must be shown on the shop drawings prepared by the Contractor, illustrating the manner in which conformity to dimensions and design is to be obtained. All such drawings will be subject
to the approval of the Owner and the installation of the article will not proceed without first obtaining said approval.

1.2 EXECUTION, CORRELATION AND INTENT

1.2.1
By executing the Contract, the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents.

1.2.2
The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. The Contract Documents are complementary, and what is required by any one will be as binding as if required by all. Work not covered in the Contract Documents will not be required unless it is consistent therewith and is reasonably inferable there from as being necessary to produce the intended results. Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance which such recognized meanings.

1.2.3
The Notice to Proceed will come in the form of a written letter to the Contractor. Once the written Notice to Proceed has been received by the Contractor, that date will be the legal start date for work under the Contract.

In the event of a failure to issue a Notice to Proceed written document specifying the commencement date, the pre-construction meeting date will serve as the Notice to Proceed date.

1.3 OWNERSHIP AND USE OF DOCUMENTS

1.3.1
All Drawings, Specifications and copies thereof furnished by the Owner are and will remain the Owner’s property. They are to be used only with respect to this Project and are not to be used on any other project without prior written consent of the Owner. With the exception of one contract set for each party to the Contract, such documents are to be returned or suitably accounted for to the Owner at the completion of the Work. Submission or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of any reserved rights.
ARTICLE 2

ADMINISTRATION

2.1 ADMINISTRATION OF THE CONTRACT

2.1.1 The Owner or its Designated Representative will visit the site at intervals appropriate to the stage of construction to familiarize himself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. However, the Owner’s Designated Representative will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work.

2.1.2 The Owner will at all times have access to the Work whenever it is in preparation and progress. The Contractor must provide facilities for such access so the Owner may perform its functions under the Contract Documents.

2.1.3 The Owner will make payments for completed work, as approved by the Owner, in accordance with M.G.L. Ch. 30, Sec. 39G. A five percent retainage will be deducted from periodic payments to the Contractor.

2.1.4 The Owner will render information necessary for the proper execution or progress of the Work within twenty (20) days of any request by the contractor or in accordance with any time limit agreed upon.

2.1.5 The Owner will have authority to reject Work which does not conform to the Contract Documents. Whenever, in his opinion, he considers it necessary or advisable for the implementation of the intent of the Contract Documents, he will have authority to require special inspection or testing of the Work whether or not such Work is then fabricated, installed or completed. Any such rejection of work will not relieve the Contractor of the responsibility for maintaining protection of the Work and the Owner’s property.

2.1.6 The Owner or its Designated Representative will review and approve or take other appropriate action upon Contractor’s submittals such as Shop Drawings, Product Data and Samples, but only for conformance with the design concept of the Work and with the information given in the Contract Documents. Such action will be taken with reasonable promptness so as to cause no delay. The Owner’s approval of a specific item will not indicate approval of an assembly of which the item is a component.
2.1.7
The Owner will conduct inspections to determine the date of Substantial Completion and Final Completion, will review written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment.

ARTICLE 3

OWNER

3.1 DEFINITION

3.1.1 The Owner is the person or entity identified as such in the Owner-Contractor Agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Owner means the Town of Burlington or its designated representative.

3.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

3.2.1 The Owner will, at the time of execution of the Agreement and any subsequent Change Orders, certify for the Contractor that financial arrangements have been made to fulfill the Owner’s obligations under the Contract.

3.2.2 The Owner will furnish all documents describing the work.

3.2.3 Except as provided in Subparagraph 4.7.1. Owner will secure and pay for necessary approvals, easements, assessments and charges required for the construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

3.2.4 Information or services under the Owner’s control will be furnished by the Owner with reasonable promptness to avoid delay in the orderly progress of the Work.

3.2.5 The Owner will furnish the Contractor with three (3) copies of all Drawings and Specifications and revisions issued during the progress of the Work; all additional copies will be furnished upon request at the cost of reproduction.

3.2.6
The Owner, through its Designated Represented, will forward all instructions directly to the Contractor.

3.3 OWNER’S RIGHT TO STOP THE WORK

3.3.1 If the Contractor fails to correct defective Work as required by the Owner or fails to carry out the Work in accordance with the Contract Documents or if the Owner will for any other reason so require, the Owner, by a written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated or until further written notice from the Owner; however, this right of the Owner to stop the Work will not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. The Contractor must resume the Work after such stoppage promptly upon written notice to do so from the Owner. If such stoppage is required through no fault of the Contractor, the Contract Time (and the dates for achieving Substantial Completion and Final Completion) will be extended by a period equal to the period of the stoppage, and the Contractor will be compensated for its reasonable and justifiable cost incurred as a result of such stoppage.

3.4 OWNER’S RIGHT TO CARRY OUT THE WORK

3.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within seven days after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedy he may have, perform such work or cause such work to be performed and/or make good such deficiencies. In such case an appropriate Change Order will be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for additional services made necessary by such default, neglect or failure. If the payments then or thereafter due the Contractor are not sufficient to cover the amount, the Contractor must pay the difference to the Owner.

3.5 OWNER’S RIGHT TO TERMINATE CONTRACT

3.5.1 The Town reserves the right to terminate this Contract at their discretion with thirty (30) days written notice to the contractor. In the event of Contract termination, all finished or unfinished work, or un-used material, already paid for under Contract prices, will become the property of the Town of Burlington.
ARTICLE 4

CONTRACTOR

4.1 DEFINITION

4.1.1 The Contractor is the person or entity identified as such in the Owner-Contractor Agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Contractor means the Contractor or his authorized representative.

4.2 REVIEW OF CONTRACT DOCUMENTS

4.2.1 The Contractor must carefully study and compare the Contract Documents and must at once report to the Owner any error, inconsistency or omission he may discover. The Contractor will not be liable to the Owner for any damage resulting from errors, inconsistencies or omissions in the Contract Documents which he discovers but will be liable for damage to the extent he reasonably should have but failed to discover such errors, inconsistencies or omissions. The Contractor will perform no portion of the Work at any time without Contract Documents or, where required, approved Shop Drawings, Product Data or Samples for such portion of the Work.

4.3 SUPERVISION AND CONSTRUCTION PROCEDURES

4.3.1 The Contractor must supervise and direct the Work, using his best skill and attention which will not be less than such state of skill and attention generally rendered by the contracting profession for projects similar to the Project in scope, difficulty and location. The Contractor must maintain adequate supervisory personnel at the Site during the performance of the Work. He will be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract.

4.3.2 The Contractor will be responsible to the Owner for the acts and omissions of his employees, Subcontractors and their agents and employees, and other persons performing any of the Work under a contract with the Contractor. This obligation will also extend to the presence on the Site of suppliers of materials or equipment, their employees, contractors, and agents engaged in the work.

4.3.3 The Contractor will not be relieved from his obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the Owner in its administration of the Contract.
4.4 LABOR AND MATERIALS

4.4.1 Unless otherwise provided in the Contract Documents, the Contractor will provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and service necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.4.2 The Contractor will at all times enforce strict discipline and good order among his employees and will not employ on the Work any unfit person or anyone not skilled in the task assigned to him including all persons on the Site controlled directly or indirectly by the Contractor.

4.5 WARRANTY

4.5.1 The Contractor warrants to the Owner that all materials and equipment furnished under this Contract will be new and of recent manufacture unless otherwise permitted in writing by the Owner and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective and, promptly after written notification of non-conformance, will be repaired or replaced by the Contractor with Work conforming to such requirements. If required by the Owner, the Contractor will furnish satisfactory evidence as to the kind and quality of materials and equipment.

4.6 TAXES

4.6.1 The Contractor will pay all applicable sales, consumer, use and other similar taxes for the Work or portion thereof provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective.

4.7 PERMITS, FEES AND NOTICES

4.7.1 Unless otherwise expressly provided in the SPECIAL CONDITIONS, the Contractor will secure and pay for all permits and fees, licenses and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required at the time the bids are received, and the same will at all times be the property of the Owner and will be delivered to the Owner upon completion of the Project.
4.7.2
The Contractor must give all notices and comply with all federal, state and local laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work. The Contractor must provide the Owner with reproductions of all permits, licenses and receipts for any fees paid. The Owner represents that it has disclosed to the Contractor all orders and requirements known to the Owner of any public authority particular to this Contract.

4.7.3
If the Contractor observes that any of the Contract Documents are at variance with applicable laws, statutes, codes and regulations in any respect, he must promptly notify the Owner in writing, and any necessary changes must be accomplished by appropriate Modification.

4.7.4
If the Contractor performs any Work which he knows or should know is contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner, he will assume full responsibility therefore and will bear all costs attributable thereto.

4.8 SUPERINTENDENT

4.8.1
The Contractor must employ a competent superintendent and necessary assistants who will be in attendance at the Project site at all times during the progress of the Work. The superintendent will represent the Contractor and all communications given to the superintendent will be as binding as if given to the Contractor. Important communications will be confirmed in writing. Other communications will be so confirmed on written request in each case.

4.9 PROGRESS SCHEDULE

4.9.1
The Contractor, immediately after being awarded the Contract, must prepare and submit for the Owner’s information an estimated progress schedule for the Work. The progress schedule must be related to the entire Project to the extent required by the Contract Documents, and will provide for expeditious and practicable execution of the Work. No work will start without the Project schedule. The Contractor must submit the project schedule five days prior to start the work.

4.10 DOCUMENTS AND SAMPLES AT THE SITE

4.10.1
The Contractor must maintain at the site for the Owner one record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, and “As-Built”
Drawings and Specifications in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data and Samples. These will be available to the Owner upon completion of the Work.

4.11 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

4.11.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

4.11.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.

4.11.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

4.11.4 The Contractor must review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents.

4.11.5 By approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that he has determined and verified all material, field measurements, and field construction criteria related thereto, or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

4.11.6 The Contractor will not be relieved of responsibility for any deviation from the requirements or the Contract Documents by the Owner’s approval of Shop Drawings, Product Data or Samples or the Owners’ approval of the same unless the Contractor has specifically informed the Designated Representative in writing of such deviation at the time of submission and the Designated Representative has given written approval to the specific deviation. The Contractor will not be relieved from responsibility from errors or omissions in the Shop Drawings, Product Data or Samples by the Owner’s approval thereof.
4.11.7
The Contractor must direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Owner or its Designated Representative on previous submittals.

Designated Representative

4.11.8
No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample will be commenced until the submittal has been approved by the Owner or Designated Representative. All such portions of the Work will be in accordance with approved submittals.

4.12 USE OF SITE

4.12.1
The Contractor will confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and must not unreasonably encumber the site with any materials or equipment.

4.13 CUTTING AND PATCHING OF WORK

4.13.1
The Contractor will be responsible for all cutting, fitting or patching that may be required to complete the Work or to make its several parts fit together properly.

4.13.2
The Contractor must not damage or endanger any portion of the Work or the work of the Owner or any separate contractors by cutting, patching or otherwise altering any work or by excavation. The Contractor must not cut or otherwise alter the work of the Owner or any separate contractor except with the written consent of the Owner and of such separate contractor. The Contractor must not unreasonably withhold from the Owner or any separate contractor his consent to cutting or otherwise altering the Work.

4.14 CLEANING UP

4.14.1
The Contractor at all times will keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work he will remove all his waste materials and rubbish from and about the Project in full compliance with all applicable laws and regulations as well as all his tools, construction equipment, machinery and surplus materials and the Project must be thoroughly cleaned and ready for immediate occupancy by the Owner.

4.14.2
If the Contractor fails to clean up at the completion of the Work, the Owner may do so as provided in Paragraph 3.4 and the cost thereof will be charged to the Contractor.
4.15 COMMUNICATIONS

4.15.1 The Contractor must forward all communications to the Owner’s designated representative.

4.16 ROYALTIES AND PATENTS

4.16.1 The Contractor must pay all royalties and license fees. He must defend all suits or claims for infringement of any patent rights and will save the Owner harmless from loss on account thereof, except that the Owner will be responsible for all such loss when a particular design, process or the product of a particular manufacturer or manufacturers is specified, but if the Contractor believes or has reason to believe that the design, process or product specified is an infringement of a patent, he will be responsible for such loss unless he promptly gives such information to the Owner, and thereafter the Owner insists on the use of the design, process or products specified.

4.17 INDEMNIFICATION

4.17.1 To the fullest extent permitted by law, the Contractor will indemnify and hold harmless the Owner, the Designated Representative, and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorney’s fees, arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and (2) is caused in whole or in part by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified there under. Such obligation will not be construed to negate, abridge, or otherwise reduce any other right or of indemnity which would otherwise exist as to any party or person described in this Paragraph 4.17.

4.17.2 In any and all claims against the Owner the Designated Representative or any of their agents or employees by any employee of the Contractor, any Subcontractor anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Paragraph 4.17 will not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or
for the Contractor or any Subcontractor under workers’ or workmen’s compensation acts, disability benefit acts or other employee benefit acts.

4.17.3
The obligations of the Contractor under this paragraph 4.17 will not extend to the liability of the Owner, the Designated Representative, their agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications, or (2) written directions or instructions given by the Owner, the Designated Representative, their agents or employees, provided they are the sole cause of the injury or damage.
ARTICLE 5
INSURANCE

Contractor must provide insurance as specified below:

**General Liability**

Includes:
- Comprehensive form
- Premises/Operations
- Underground Explosion & Collapse Hazard
- Products / Completed Operations
- Independent Contractors
- Broad From Property Damage
- Personal Injury

<table>
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<th>Each Occurrence</th>
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<tbody>
<tr>
<td>Aggregate</td>
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</tbody>
</table>

**Automobile Liability**

Includes:
- All Owned Vehicles
- Hired Vehicles
- Non-owned Vehicles

| Bodily Injury & Property Damage Combined | $1,000,000 |

**Workers Compensation & Employers Liability**

- As Required by State of Massachusetts

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<td>Bodily Injury by Disease (Policy Limit)</td>
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</tr>
<tr>
<td>Bodily Injury by Disease (Each Employee)</td>
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</tbody>
</table>

**Additional Insurance / Requirements**

- The Town of Burlington Will be named as Additional Insured
ARTICLE 6
LIQUIDATED DAMAGES

6.1 LIQUIDATED DAMAGES

If the Contractor neglects, fails or refuses to complete the work as herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to Owner the amount of $1,000 per day, not as a penalty but as liquidated damages for such breach of Contract as hereinafter set forth, for each and every calendar day that the Contract will be in default after the date(s) stipulated in the Contract for completing the work.
SPECIFICATIONS

Item 120.1 – Unclassified Excavation

The work under this item must conform to the relevant provisions of Section 120 of the Standard Specifications and the following:

The work will include the disposal of existing materials shown on the drawings to be removed and reset, but which in the judgment of the Engineer are unsuitable for reuse in the proposed work and their disposal is not included under another item of this Contract.

The work will also include the excavation of material of every description regardless of the type encountered, from within the project limits as shown on the drawings, and as directed by the Engineer, and except those materials for which excavation is included with the work specified to be performed under other items of this Contract.

Item 153. – Controlled Density Fill (Excavatable)

Controlled density fill (CDF) must be used to backfill excavations and trenches for conduits constructed in existing pavement areas that are to remain. Controlled density fill must not be used to backfill utility excavations or trenches in areas of full depth pavement construction.

Controlled density fill must conform to the requirements of Section M4.08.0 Type 1E.

Item 191. – Drive Sample Boring

Item 191.11 – Core Boring

Item 193. – Mobilization and Dismantling of Boring Equipment

The work under these items must conform to the relevant provisions of Section 190 of the Standard Specifications and the following:

The work under these items will include mobilization and set-up of boring equipment, the drilling of hollow stem auger borings, drive sample borings and rock core borings, the retrieval of soil samples, the visual classification of the soil, the recording of boring logs and samples, and the dismantling and transporting of the equipment to and from each site.

Hollow stem auger borings will be taken at the locations of the proposed traffic signal foundations as shown on the plans and as directed by the Engineer. The Engineer must be notified a minimum of 72 hours before borings are taken.

Two types of samples will be required in vertical soil borings:

1. Standard Sample: A standard penetration test using a split spoon sampler will be made at the ground surface and at every change in soil stratum, but the sampling intervals must not exceed 5 feet in a continuous stratum. The auger hole will terminate at the required bottom elevation and a split spoon sample must be taken at the bottom of the hole.

2. Supplement Sample: A volume sample will be taken at 5-foot intervals in order to classify the subsurface soils with respect to grain size and visual classification as
required. Each sample must consist of the remainder of the spoon sample and must be contained in quart jars appropriately labeled.

The purpose of this method along with its sampling procedure is to determine the visual properties, arrangement and thickness of the various soil strata as they exist in the ground. The elevations/depths at which any change in stratification occurs must be located and recorded on the log by the driller. Detection of stratum changes should be made by careful observation of the soil as it exists in the augered hole and by the rate of penetration of the auger during drilling.

The auger casing I.D. must be a minimum of 2-3/4 inches for all holes in which split spoon samples are required. The O.D. must be a maximum of 7 inches to limit the size of the resulting hole.

The quart jar samples must have positive identification of the contents by typewritten glued-on label.

The following information must be shown:

a. Name and address of the boring contractor.
b. Date the sample was taken.
c. The location and name of project.
d. The location of borehole by station and offset or identifying number of borehole, if so identified on the plan.
e. The depth below ground surface at which sample was obtained and recorded blow counts of 6 inches of penetration of the sampler.

Upon completion of all borings, the Contractor must submit two copies of the typewritten boring logs to the Engineer.

Obstructions

Obstructions other than ledge will be considered in accordance with Subsection 190.60E of the Standard Specifications. The actual location of the additional boring will be specified by the Engineer. When ledge is encountered, a rock core boring will be made in accordance with Sub-section 190.63 of the Standard Specifications.

Rock Core

If rock is encountered at an elevation above the specified highest bottom elevation, then a rock core boring will be made in accordance with Subsection 190.63 of the Standard Specification. The core hole must be large enough to accommodate the required auger casing so that sampling may be continued past the rock obstruction. The minimum cored depth must be 10 feet.

Practical Refusal

Practical refusal of the sample spoon or "refusal" is as defined by Subsection 190.60F of the Standard Specifications.
Due to the size of the resulting auger hole, it is particularly important that upon completion, all borings will be backfilled with clean, well-graded sand and tamped to fill all voids created during the augering procedure.

**Advancing the Boring for Soil Sampling**

As the boring is advanced, care will be taken to note and record the depth where wet soil is encountered if this should occur.

If groundwater is encountered then the water level in the hollow stem must be maintained at the top of the casing at all times during the sampling operation to avoid unequal hydrostatic pressure that could result in blow-in of fine-granular soils and inaccurate blow counts.

In each boring the driller will record the water level prior to backfilling and whenever possible, prior to the start of each day's work.

Each boring must be advanced by using a hollow stem auger with cutting head and center rod and plug assembly. The hollow stem auger will advance and case the hole simultaneously to the required sampling levels. The center rod and plug assembly is held in place by the cap and inside drill rod connecting the auger and its assembly to the rotating spindle on the drilling machine to prevent soil from entering the mouth of the auger. Upon reaching the sampling level, the plug is to be retreated by withdrawing the center rod to permit lowering of the sampler through the auger.

The sample will be obtained by driving the sampler 18 inches into the undisturbed material below the bottom of the auger. The sampling and handling procedure must be as specified under Sub-section 190.61 of the Standard Specifications.

After the sampling operations are completed and the sampler has been retracted, the plug is re-inserted and held in place by the center rod; another auger section is connected to the first, together with one additional center rod section to secure the plug to the cap and the hole is advanced.

This procedure will be repeated until the required bottom elevation is reached. The auger will be stopped at any depth level to allow normal sampling practices upon request by the Engineer.

If, in the judgment of the Engineer, the borehole cannot be advanced by the hollow stem auger method due to the material encountered (with the exception of bedrock) and every attempt has been made by the driller to complete the boring using the conventionally cased, drive sample, wash boring method as specified in Section 190 of the Standard Specifications, then the borehole must be cored.

**Item 472. – Hot Mix Asphalt for Miscellaneous Work**

The work under this Item must conform to the relevant provisions of Section 460 of the Standard Specifications and the following:

Asphalt mixtures under this Item must be placed only where and as directed by the Engineer.
The Contractor is advised that this material will have to be placed primarily by hand methods, with no additional compensation.

The mixture selected must determine the applicable specification section and the relevant provisions therein.

**ITEM 482.3 – Sawing Asphalt Pavement**
**ITEM 482.4 – Sawing Cement Concrete**

The work under these items must conform to the relevant provisions of Section 120 of the Standard Specifications and the following:

The work must include the sawcutting of existing asphalt and cement concrete pavements where shown on the plans, and as directed by the Engineer.

Sawcut equipment must be approved by the Engineer prior to commencing work.

The existing pavement must be sawcut through its full depth, or to the elevation of the abutting proposed pavement subgrade, whichever is lesser, at all joints between existing and proposed pavements, and at all utility trenches through existing pavement to remain, to provide a uniform, vertical surface for the proposed pavement joint with the existing pavement.

Sawcut edges which become broken, ragged or undermined as a result of the Contractor's operations will be re-sawcut prior to the placement of abutting proposed pavement at no additional cost to the Owner.

Sawcut surfaces in asphalt pavement must be sprayed or painted with a uniform, thin coat of RS-1 asphalt emulsion immediately before placement of hot mix asphalt material against the surfaces. Sawcut surfaces abutting the proposed pavement top course must be coated with HMA Joint Sealant.

**Item 804.3 – 3-Inch Electrical Conduit Type NM Plastic (UL)**

The work under this Item must conform to the relevant provisions of Section 801 of the Standard Specifications and the following:

The work will include the furnishing and installation of 3-inch non-metallic conduit for the traffic signal system in accordance with the plans and as directed by the Engineer.

The conduit material must be Schedule 80 polyvinyl chloride (PVC) plastic conduit.

The linear footage of conduit estimated under this Item is not guaranteed by the Engineer; it may be increased or decreased by the Engineer depending upon actual conditions encountered as provided for in Section 4.06 of the Standard Specifications.

Where new conduits are installed in existing grass areas outside the limits of grading, the work will include the placement of a minimum of 4 inches of topsoil and sod to restore the disturbed areas to their original condition, unless otherwise directed by the Engineer. No separate payment will be made for this work, but all costs in connection therewith will be included in the Contract lump sum price bid.
Where conduit is installed in existing sidewalk or paved median areas to remain, the work will include replacement of the gravel base material and the surface pavement to match preconstruction conditions unless otherwise noted on the plans. No separate payment will be made for this work, but all costs in connection therewith will be included in the Contract lump sum price bid.

**Item 816.01 – Traffic Signal Reconstruction**

The work under this Item must conform to the relevant provisions of Section 800 of the Standard Specifications, the 2009 Manual on Uniform Traffic Control Devices (MUTCD), and the following:

The work will include the furnishing and installation of part or all of the following items: local traffic signal controller; cabinet and foundation with concrete pad; mast arm assemblies with anchor bolts and foundations; signal posts and foundations; pull boxes; signal heads; backplates; pedestrian signals with countdown timers; pedestrian push buttons with signs; thermal vehicle detection; emergency vehicle preemption; all cable and wiring; ground rods, equipment grounding and bonding; and all other equipment, materials and incidental costs necessary to provide complete, fully operational traffic control signal system as specific herein and as shown on the plans. The location is as follows:

- Bedford Street (Route 62) at Middlesex Turnpike Extension

Lists of the major traffic signal items required at this location is included on the plans.

**Shop Drawings**

Within 30 days following execution of the Contract, the Contractor must submit shop drawings for signal supports, a list of equipment, and manufacturer's equipment specifications to the Engineer in accordance with the relevant provisions of Section 815.20.

No work will be commenced by the Contractor until approval of the shop drawings and manufacturer's data has been received in writing from the Engineer. Approval of these drawings will be general in character and will not relieve the Contractor from the responsibility of, or the necessity of, furnishing materials and workmanship conforming to the plans and specifications.

The Design Consultant must return the shop drawings within 15 days from the date of receipt from the Engineer.

The Contractor will deliver to the Engineer a certificate of compliance with the manufacturer for all materials purchased from the manufacturer.

**Existing Installation**

The existing signal system to be reconstructed under this Item will be maintained in operation throughout the construction period and until the new signal is ready for operation.
It will be the responsibility of the Contractor to provide all labor, equipment and material required for the total maintenance and repair of all proposed traffic signal control equipment, including damage by automobile accidents until final completion and acceptance of the project. These provisions will apply to the signalized location included as part of this construction Contract from the date of written notice given to the Engineer that the Contractor will work on or adjacent to an existing signal until the date when the Town accepts the complete project. This written notice must be given before the Contractor may proceed with any work on the specified traffic signal location. For the purpose of these Special Provisions, the phrase “Traffic Signal Control Equipment” is intended to include, but is not limited to, controllers, signal housings, supporting structures, cabinet accessories and panels, wires, conduit and all other ancillary electrical equipment used for traffic control.

The Contractor may use temporary supports for signal heads as necessary to allow construction activities. Any temporary installations must be in conformance with the MUTCD at all times. If an existing signal is to be turned off temporarily to allow controllers switch overs or rewiring, police detail must be used to control traffic at the intersection.

Once construction is completed and the new signal is in operation, unused items of the old signals will be completely removed and disposed of as directed by the Engineer in accordance with Section 815.65. Old cable and unusable materials will also be disposed of by the Contractor.

**Fine Tuning, Adjustment, and Testing Period**

After the Contractor has finished installing the controller and all other associated signal equipment and after the Contractor has set the signal equipment to operate as specified in the Contract documents, the fine tuning, adjusting and testing period will begin. The Contractor must advise the Engineer, in writing, of the date of the beginning of the fine tuning and testing period. This period will not start until the work at the intersection is complete. During this period, the Contractor, under the direction of the Engineer, must make necessary adjustments and tests to insure safe and efficient operation of the equipment. This period must not last for more than 30 days and the Contract completion date has taken this testing period into consideration. No request for final acceptance will be considered until successful completion of the testing period.

The Contractor must notify the Engineer in writing of the starting date of the fine tuning period prior to the starting date.

**Guarantee After Final Acceptance**

The Contractor must diagnose (troubleshoot) the system and replace any part of the traffic signal system found to be defective in workmanship, material or manner of functioning within six months from date of final acceptance of all the installations under this Contract. This requirement does not affect the one-year warranty period on equipment specified in Subsection 815.20 of the Standard Specifications.
Upon the date of acceptance of the project by the Town, the Contractor must turn over all guarantees and warranties to the Town of Burlington.

Service Connection
The service connection shown on the plans is approximate only. The Contractor must determine exact location from the servicing utility, arrange to complete the service connection, and be responsible for all charges incidental thereto.

The respective utility company is responsible for making the connection from the respective risers to the overhead wires.

Testing of Grounding System
The Contractor will perform testing of the equipment grounding system in the presence of the Engineer in accordance with MassDOT Standard Specifications.

Flashing Operation
Changes from automatic flashing to stop-and-go operation and from stop-and-go to automatic flashing operation must occur as set forth in the MUTCD.

Traffic Signal Equipment
The traffic signal controller unit (CU) malfunction management unit (MMU), cabinet power supply, bus interface units (BIU), and all other ancillary traffic signal control components included in the traffic control cabinet must comply with the National Electrical Manufacturers Association (NEMA) Standard No. TS 2-2003 (R2008) v02.06 and Amendment 4-2012 Traffic Controller Assemblies with National Transportation Communications for ITS Protocol (NTCIP) Requirements.

Traffic Signal Controller
The traffic controller supplied must conform to Section 3 “Controller Units” of the NEMA TS 2 Standard. The traffic controller must be supplied in a TS 2 Type 1 Configuration as required in the list of major traffic signal items included on the plans. Specifically, the controller unit (CU) must be supplied as an actuated controller with NTCIP capabilities; defined as Type A1N in Subsection 3.2 of the NEMA TS 2 Standard.

The TS 2 Type 1 cabinet will, at a minimum, meet the requirements of configuration 3 as defined in Table 5-2, “Type 1 Configurations” of the NEMA TS 2 Standard and according to the Item number listed above and on the traffic signal plans.

The controller unit must utilize an interface conforming to Subsection 3.3 of the NEMA TS 2 Standard. The controller unit must utilize an input/output interface conforming to the requirements of Paragraph 3.3.1 for all input/output functions with the Terminals and Facilities (TF), Malfunction Management Unit (MMU), detector rack assemblies and auxiliary devices. The controller unit must also meet the requirements of Paragraph 3.3.6 of the NEMA TS 2 Standard.
The controller unit must be supplied with Port 1, Port 2, and Port 3 as defined by the requirements of Subsections 3.3.1, 3.3.2, and 3.3.3, respectively. It must include a temperature compensated, 8 line by 40 character display with LED backlight. The controller operating system (OS) must be Linux and contain a Flash File System to allow for controller software upgrades.

The controller must support 1/10th second high-resolution data logging which provides detailed operational information allowing for the generation of enhanced performance metrics. This would include construction of Purdue Coordination Diagrams, time space diagrams and measures of effectiveness.

The controller unit must be the same as to make and model to insure compatibility for future use with the existing Adaptive Traffic Signal Control system currently in place in the Town.

The controller unit must meet the approval of the Town of Burlington. **Note: As part of the shop drawing submission the Contractor must provide written approval of the controller unit from the Town of Burlington.**

**Malfunction Management Unit**

The malfunction management unit (MMU) must comply with Section 4 of the NEMA TS 2 standard, as defined by amendment 4-2012. The MMU must be supplied as a NEMA MMU designation “MMU2” as defined in table 4-1 of the NEMA standards. The MMU must operate as either a Type 16 with 16 channels (8 vehicle, 4 pedestrian and 4 overlap) or a Type 12 with 12 channels (8 vehicle, 4 overlap). The MMU supplied must be configured to operate as a Type 16 unit. The MMU must be supplied with an Ethernet port and must support Ethernet communications. The Malfunction Management Unit must have the functionality to support MUTCD’s flashing yellow operations.

The MMU in either the Type 16 or Type 12 configuration must operate in a NEMA TS 2 Type 1 cabinet, a NEMA TS 2 Type 2 cabinet, or a NEMA TS 1 cabinet without loss of functionality.

**Thermal Vehicle Detection System**

The Contractor will furnish and install a thermal vehicle detection system that detects vehicles on a roadway by processing thermal images sent from a sensor to a detection module with detector outputs that can be received by the traffic signal controller. These thermal traffic sensors will be installed at the locations shown on the plans and in accordance with these specifications. The thermal detection system also, at a minimum, must be able to collect and store volume, speed, and classification of vehicles.

**General Description**

The thermal vehicle detection system supplied must meet the following minimum requirements:

1. The detection system must be non-intrusive (i.e. above ground) and must consist of:
   a. Mounting bracket
b. Thermal traffic sensor
c. A detection module with video detection software
d. Communications cable

2. The thermal traffic sensor and detection module must be integrated in one housing without the need for any additional detection software outside of this housing. By using one or more predefined detection zones, the detection software must have the ability to detect vehicles and bicycles on multiple lanes. Bicycle detection zones must be separate from vehicle detection zones and will utilize a different set of detection algorithms and parameters.

3. The detection software must have the ability to differentiate between vehicles and bicycles with a high level of accuracy and allow for separate outputs to be used for vehicle presence and bicycle presence.

4. The detection system must generate separate vehicle and bicycle presence events and counting data. The generated vehicle and bicycle presence events will be sent to a traffic signal controller.

5. The operator must be able to view the streaming video images of the detection system using a standard web browser such as Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome.

**Hardware**

The detector bracket allows horizontal and vertical mounting and is made of fiber reinforced polyamide (with an aluminum tube). To attach the housing on existing or new infrastructure, it is sufficient to use 2 bolts or 2 stainless steel bands.

The housing of the camera and detection module must be black, compact and esthetical. It must be made of aluminum.

A red detection LED, clearly visible from the ground, allows both the vehicle drivers and maintenance personnel to see the status of the video detection module (i.e. detection, boot mode, safe status).

The thermal traffic sensor must not depend on any visible or invisible (infrared) illumination or image intensifier to “see” i.e. produce images. The thermal traffic sensor must be totally passive and not produce any energy or emit light in any bandwidth. The thermal traffic sensor must allow the user to clearly identify images in the total absence of light.

The thermal traffic sensor must improve user visibility through smoke, fog and dust compared with visible cameras.

The thermal traffic sensor must improve detection through smoke, fog, dust, sunny and wet conditions compared with visible cameras.

The thermal traffic sensor must utilize a Vanadium Oxide (VOx) uncooled microbolometer responding in the LWIR (Long Wave Infrared) spectral range of 7.5–13.5μm.
The thermal traffic sensor must be based on Vanadium Oxide (VOx) microbolometer
detector technology, and must not be susceptible to permanent damage after imaging
the sun.

The thermal traffic sensor must not utilize dynamic apertures to protect the image
sensor because these mechanisms reduce sensitivity for an extended period of time,
thus reducing the Thermal Traffic Sensor performance, which must not be acceptable
for traffic installations.

The thermal traffic sensor must provide thermal optics that automatically adjusts to
background thermal changes, and therefore does not require readjustment and/or
thermal refocusing.

The thermal traffic sensor must not be susceptible to “image blooming” caused by
bright lights as are image intensifiers and visible spectrum sensors.

The thermal traffic sensor must be factory configured with an antireflection hard
carbon coated Germanium lense.

The thermal traffic sensor must have various focal length options to allow vehicle
presence detection on short distance (closer than 80 feet), medium distance (between
50 and 250 feet) and long distance (up to 400 feet).

The thermal traffic sensor image sensor must provide a Noise Equivalent
Temperature Difference (NETD) of < 75mk, <50mK f/1.0 or lower.

The thermal traffic sensor must include Auto Digital Detail Enhancement (Auto
DDE) which is an advanced non-linear image processing algorithm. The Auto DDE
function is fully automatic and requires no input or adjustment from the user. The
Auto DDE must enhance the image detail to match the total dynamic range of the
original image allowing details to be visible to the user even in scenes with low or
high thermal contrast. Auto DDE will increase the probability of detection of low
contrast images. These settings must be optimized for performance with Traffic
Thermal Detection.

The thermal traffic sensor must utilize Non-Uniformity Correction (NUC) which is a
set of compensation factors for each pixel. NUC must enable the following features
and benefits:

- Eliminate the need for FPA (Focal Plane Array) temperature stabilization
- Allow for near instantaneous sensor turn-on
- Reduced system complexity and power consumption
- Allow for a wider operating temperature range

The thermal traffic sensor must include Automatic Gain Control (AGC) circuitry to
compensate for scene variations, improve image quality by avoiding saturation and
distortion, and to balance signal levels prior to display to maximize image quality.

The thermal traffic sensor must feature a White-Hot operating mode. In the White-
Hot mode warmer objects will be displayed in white or lighter shades than cooler or
background areas.
The thermal traffic sensor must provide IP video stream.

The detection system supports streaming video in MJPEG, MPEG-4 and H.264 format. To meet the limitations of the network, the bit rate and frame rate of the video stream must be user-configurable.

To store the gathered vehicle and bike count data, the detection module must have an on-board memory of at least 2 weeks under the following configuration parameters: 2 detection zones, differentiated counts for bicycles and vehicles, 5-minute integration intervals.

The video detection module is capable of operating at 24VAC/DC, provided to the sensor via the interface board. Its power consumption will not exceed 5W (or 210mA at 24V) during regular operations.

The total mass of the bracket, housing, camera and video detection module (excl. cabling) must be less than 2.5 pounds.

The interface board is used for system configuration, detection verification, detection output generation and error output generation. It will be an EDGE card for NEMA TS-1 & TS2, 170 and 2070 cabinets. It allows connection to up to 8 video detection modules and has an Ethernet connection to communicate with a PC, and a USB port.

The interface board provides 4 contact closures (detection outputs) or serial output state information (SDLC, via SDLC module) for the traffic light controller. Also, an error output is present.

If more than 4 detection outputs are necessary, one or more EDGE expansion boards, each with 4 contact closures, will be available and connected to the interface.

Communication between the interface board and the different cameras must be established over BPL (Broadband over Power Lines), limiting the number of wires per camera to maximum 3 (BPL+, BPL-, Ground).

**Regulatory Specifications**

- The video detection module will comply with applicable CE directives:
  - Electromagnetic Compatibility directive 2004/108/EG
  - Safety – Low voltage directive 2006/95/EC
  - Reduction of hazardous substances directive 2011/65/EU
- The video detection module will be compatible with NEMA TS2 (Traffic controller assembly product standard)
- The video detection module will comply with FCC Title 47 Part 15 Subpart B

**Environmental Specifications**

- The video detection module will be capable of operating between -40°C and +80°C
- The video detection module will be UV resistant
- The video detection module will be mechanically protected according to IP67 and IK07
- The video detection module will require a minimum of maintenance
Functionalities

*Vehicle presence detection, counting and zone occupancy measurement:*

In one or more predefined virtual vehicle presence detection zones, the video detection software will detect both moving and stopped vehicles on multiple lanes when mounted 4-12m above the street’s surface, taking into account optical occlusion constraints.

In total, it must be possible to put 24 virtual detection zones in the image. Logical functions (AND, OR) must be used to link multiple virtual detection zones to a single output. Detection must be in any direction through the image and in more than 1 direction. Configuring an extend and/or delay time for detection must be possible.

The count and zone occupancy information must be provided via contact closures, where the number of pulses indicate the count and the length of the pulses indicate the zone occupancy.

Vehicle count and zone occupancy data generation via TCP/IP and storage via on-board memory must be possible.

The detector will support integrated data collection for vehicle presence, with user selectable data interval:

- Date and time
- Zone number
- Number of vehicles per vehicle presence zone
- Zone occupancy per vehicle presence zone

*Bicycle Presence Detection and Counting:*

In one or more predefined virtual detection zones, the video detection software will detect both moving and stopped bicycles on multiple lanes when mounted 12-40 feet above the street’s surface, taking into account optical occlusion constraints. The software must differentiate bikes from other vehicles.

In total, it must be possible to put 4 virtual detection zones in the image.

The bicycle presence and bicycle count information must be provided via contact closures. For the counts, the number of pulses indicate the count. Vehicle count and zone occupancy data generation via TCP/IP and storage via on-board memory must be possible.

The detector will support integrated data collection for bicycle presence, with user selectable data interval:

- Date and time
- Zone number
- Number of bicycles per bicycle presence zone
Traffic data collection and traffic flow monitoring:

In one or more predefined virtual detection zones, the video detection software will collect traffic data, and monitor the traffic flow, when mounted 20-40 feet above the street’s surface, taking into account optical occlusion constraints. In total, it must be possible to put 4 virtual detection zones in the image.

The sensor will support the following functionalities:

- Traffic flow monitoring with 5 levels of traffic flow, to be provided via contact closures or TCP/IP:
  - Fluent traffic
  - Dense traffic
  - Delayed traffic
  - Congested traffic
  - Stop & Go traffic

- Integrated traffic data collection, with user selectable data interval and following information:
  - Date and Time
  - Lane Number
  - Vehicle Classification (maximum 5 classes)
  - Number of Vehicles per Lane and per Vehicle Class
  - Average Speed per Lane and per Vehicle Class
  - Zone Occupancy

For data, the sensor is able to work as a stand-alone system, in which case it is possible to connect a portable PC directly to the detection module interface board using the TCP/IP connection. In this setup, the detection module will store the gathered traffic data and traffic events in its internal memory. Data is downloaded by connecting a portable PC to the detection module interface TCP/IP port.

The sensor can also be used in combination with a fixed link that provides the captured data and/or events to a remote traffic management system for immediate interpretation. In this setup the detector must be connected directly to a network using the TCP/IP connection on the interface board.

Software

The system is configured using dedicated software on a PC. The software can run on Windows XP, Windows Vista, Windows 7 and Windows 8. The program must be user-friendly and must use a JPEG snapshot of the sensor image to place the virtual detection zones on the road’s surface in a simple and accurate way. It must be possible to set up, add, change and delete up to 24 direction-sensitive vehicle presence detection zones and 4 direction sensitive bicycle presence detection zones. In the setup GUI, the user must be able to define various parameters such as integration interval and differentiate between vehicle and bicycle zones. It should be possible to change the configuration without disrupting normal operation. It must be possible to view, record and playback video sequences by using dedicated software (e.g. VLC Media Player) that can be installed on a portable PC.
**Warranty, Maintenance and Support**

1. The thermal traffic sensor engine must be warranted by its supplier for a minimum of ten (10) years.
2. The thermal traffic vehicle detection system must be warranted by its supplier for a minimum of two (2) years.
3. During the warranty period, the supplier must provide technical support by telephone during normal business hours and request for support by telephone must be answered by factory certified personnel within one (1) hour.
4. During the warranty period, certified personnel from the supplier must be on site within seventy-two (72) hours if required.

**Vehicle Detection Software Management System**

The Contractor must provide and install a management system designed to allow for remote monitoring, data collection and control for future use. The management system must be compatible with the detection system supplied as part of this project.

**Video BIU Module**

The Video BIU module must be compatible with NEMA TS2 detector card racks and must meet the following requirements:

- Must support 64 detector inputs.
- Must select TS-2 detector BIUs to emulate and operate up to 4 BIUs simultaneously.
- Must provide SDLC interface for video processing cards.
- Allow for multiple detection zones to be assigned to the same camera.

**Detector Rack Assemblies**

The detector rack assemblies must conform to Paragraph 5.3.4 of the NEMA TS 2 Standard. The detector rack assembly must be supplied in a Type 2 configuration as defined in Table 5-9 of the NEMA TS 2 Standard.

**Cabinet Power Supply**

Separate power supply must be supplied and installed in the TS 2 cabinet. As a minimum, the power supply must meet all requirements of Paragraph 5.3.5 of the NEMA TS 2 Standard. The unit must be AC line powered and provide regulated DC power, unregulated AC power, a line frequency reference for the load switches and other auxiliary cabinet equipment as required.

The power supply must be either shelf or rack mounted.

The unit must contain four LED indicators on the front panel to indicate the four outputs;

1. + 12 VDC +/- 1 VDC @ 2.0 amps,
2. + 24 VDC +/- 2 VDC @ 2.0 amps,
3. 12 VAC @ 250 milliamps, and
4. 60 Hz line frequency reference.
A test point terminal must also be located on the unit front panel for + 24VDC and logic ground testing.

Surge Suppression

The Contractor must supply and install surge suppression in the traffic controller cabinet in accordance with MassDOT Standards. Contractor must contact the Engineer directly for requirements and/or questions. At a minimum surge suppression must be provided for, video detection, power service, and emergency preemption.

Load Switches

Load switches must comply with Subsection 6.2 of the NEMA TS 2 standard. All load switches must utilize optically isolated encapsulated modular solid state relays. Discrete components on circuit boards are not acceptable.

Load switch indicator lights must be LED-type and wired on the input side of the device.

Flasher

Flashers must comply with Subsection 6.3 of the NEMA TS 2 standard and be equipped with two output indicator lights which will show flashing power out to the cabinet assembly.

Flash Transfer Relays

Flash transfer relays must comply with Subsection 6.4 of the NEMA TS 2 standard.

The field electrical loading for flash operation must be wired through the transfer relays such that the load on the 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.

Traffic Controller Cabinet

Controller cabinet must conform to the NEMA TS 2 Standards, Section 7. Cabinet sizes must be as indicated on the plans and as shown below.

<table>
<thead>
<tr>
<th>Item #</th>
<th>NEMA TS 2 Cabinet Size</th>
<th>Nominal Cabinet Size (HxWxD)*</th>
<th>Configuration Type Table 5-2</th>
<th>Load Switch Positions</th>
<th>Flash Transfer Relays</th>
<th>BIUs Required</th>
<th>Detector Rack Type Table 5-9</th>
<th>MMU2 (Channels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>816.01</td>
<td>6</td>
<td>52x44x24</td>
<td>3</td>
<td>12</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>16 Channel</td>
</tr>
</tbody>
</table>

* Approximate cabinet dimensions are provided in inches.

The cabinet must be made of aluminum.

Where applicable, the cabinet must be installed with the door opening positioned in order to allow general observation of the flow of traffic and the inside of the cabinet at the same time.

Controller cabinet foundation must not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons is impaired.
GFI Duplex Outlet

The Contractor must supply and install a second separate GFI protected duplex outlet in the controller cabinet, and mounted on the side wall of the cabinets for servicing other devices.

Manual Override (Police Control Button)

The Contractor must provide and install a fully wired, environmentally sealed momentary contact (push button) hand held switch must be supplied with a retractable cord that will extend approximately 6 feet.

Provision must be made for neat cord and hand held switch storage within the police panel. This hand held switch and retractable cord must be permanently wired and must not be plugged-in removable.

Manual operation of the controller must provide the same color sequence as was programmed for the automatic operation. The duration of all intervals, except the yellow vehicle and red vehicle clearance interval, must be controlled by operation of the remote manual control switch. Duration of the yellow interval and red clearance interval must be the time specified to be programmed in the controller unit.

Bus Interface Units

The Bus Interface Units (BIU) must comply with Section 8 of the NEMA TS 2 Standard. The BIU must be fully interchangeable with any other manufacturer’s unit and interchangeable in a NEMA TS 2 Type 2 cabinet assembly.

At a minimum the BIU must perform the interface function between port 1 at the controller unit, the malfunction management unit (MMU), the detector rack assembly (video detection), and the terminal facilities. The cabinets must be supplied with the appropriate number of BIUs required to provide an operating traffic control signal according to the plans and these specifications.

As a minimum, two LED indicators must be provided on the BIU front panel. One indicator must serve a dual use; as a power on indication and as a diagnostic indicator for proper operation of the device. The second indicator must serve as a transmit indicator illuminating each time data is transmitted.

Spare Equipment

The Contractor must provide the following spare signal equipment in the proposed traffic signal controller cabinet:

- A full complement of load switches to accommodate each available position of the back panel.
- A full complement of flash transfer relays to accommodate each available position of the back panel.
- Two (2) Bus Interface Units.
- A 25 foot RS-232 cable for communication function with a laptop computer.
Emergency Preemption

The emergency vehicle preemption system must be Global Traffic Technologies, LLC (GTT) OPTICOM Priority Control System Model 700 series, or approved equivalent, installed in the same cabinet as the controller.

The emergency vehicle preemption control system must consist of a data-encoded phase selector to be installed within the traffic control cabinet in the detector racks. This unit will serve to validate, identify, classify, and record the signal from the optical detectors located on support structures at the intersection.

Upon receiving a valid signal from the detector, the phase selector must generate a preempt call to the controller initiating a preemption operation as shown on the plans.

The optical detector must be single input, single output unit used to control one approach. The optical detector must be OPTICOM model 711 series or approved equal. All traffic signal installations must be supplied with a minimum of two optical detectors unless otherwise noted in the major items list.

The phase selector must be a rack-mounted plug-in four channel dual priority device OPTICOM model 754 series or approved equal. The phase selector must plug into an empty slot in the detector rack. Programming the phase selector must be via a PC-based computer utilizing unit specific software. One copy of preemption programming software on a CD must be supplied and licensed to the Town of Burlington. A hard copy of final programming data must be left in the control cabinet. A complete set of interface cables for phase selector to laptop connection must be supplied in the cabinet.

The Contractor must install a confirmation strobe at the traffic signal location as shown on the plans. The confirmation strobe must serve to validate to the driver of the emergency vehicle that the traffic signal has recognized the preemption call and will initiate the proper preemption sequence. The confirmation strobe must be a white lens Whelen IS3 series or equivalent.

The Contractor must be responsible for the proper programming of the phase selector, orientation of the optical detectors, and all other work necessary to provide complete and operating emergency vehicle preemption systems. The Contractor may be required to field adjust the location of the optical detectors in the presence of the Engineer to properly detect preemption calls from approaching vehicles. Upon final inspection and testing, any discrepancies or failures to properly preempt the traffic signals will necessitate a complete replacement on any non-compatible equipment.

Mast Arms, Poles and Foundations

Mast arm poles must be fabricated and constructed in conformance with the 2015 MassDOT Standard Drawings and as stated below.

All mast arm poles must be Type 2, galvanized steel monolevers with shoe bases. Acceptance of Type 2 mast arm poles will be contingent upon review and approval of shop drawings submitted by the Contractor. Longhand design calculations must be submitted by the Contractor with the shop drawings for all Type 2 mast arm poles.
The Contractor must provide a set of calculations, stamped by a Structural Engineer registered in the Commonwealth of Massachusetts, along with plans and specifications for review by the Project Engineer.

The Contractor will be responsible for performing all soil borings and soil classifications associated with the mast arms and poles. Reference is made to Items 191, 191.10, 191.11, and 193 for more information.

All mast arm pole foundations must be cored pier foundations and constructed in conformance with MassDOT Standard Drawings. Foundation sizes and depths must be selected from the foundation design charts shown in MassDOT’s Standard Drawings.

Prior to installation, the Contractor must notify the Engineer in writing of his selection of mast arm foundation footing sizes.

The Contractor is wholly responsible for the design of all foundations regardless of soil conditions and/or ledge found at the proposed foundation locations. In the event that unforeseen soil conditions are encountered that prevent the use of MassDOT standard foundation type, the Contractor is responsible to select and design alternative foundation types. Alternative foundation types could include spread footings, coring and socketing into rock or other foundations previously used to support similar loads, within reason.

The Contractor must submit the alternative foundation type to the Engineer for review. The alternative foundation type must be stamped by a Structural Engineer registered in the Commonwealth of Massachusetts.

No separate payment will be made for work considered incidental to the excavation, including but not limited to, mast arm foundations, dewatering, etc. but all costs in connection therewith must be included in the contract lump sum bid price.

Foundation must not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons is not impaired.

**Signal Heads**

Signal heads mounted on mast arms must be rigidly attached to the mast arms. All signal heads mounted overhead on mast arms must be installed, with the bottom of the signals at the same height. All traffic signal lenses must be 12 inches in diameter. All signal heads must be equipped with ball and/or arrow light emitting diode (LED) modules. Five (5) inch non-louvered backplates and tunnel visors must be provided on all signal heads. All backplates must include 3-inch wide, yellow reflective micro-prismatic retroreflective sheeting conforming to ASTM D4956 Type VIII or better on the outside edge of the backplates.

**Red, Yellow, and Green LED Vehicle Signal Module**

Any equipment that has been type-tested and approved according to Section 815.21 of the Standard specifications prior to the date of award of this contract will be considered as meeting these specifications.

All Red, Yellow, and Green signal displays must conform to the following:

Yellow LED signal modules must conform to the above specifications with the exception that yellow modules must meet maintained Minimum Luminous Intensity values of Table 1, Section 4 of the above referenced ITE specification of compliant green signal modules at 25 degrees Celsius at 120 volts AC, throughout the useful life based on normal use in traffic signal operation over the operating temperature range.

All signal modules must conform to the following: (In case of a conflict, the following special provision must overrule.)

An independent laboratory must certify that the LED signal module complies with Section 6 Quality Assurance of the above stated ITE LED Purchase Specification.

LED signal modules must be type tested and approved by MassDOT according to the requirements of Subsection 815.21 of the Standard Specifications for Highways and Bridges.

On the backside of the LED signal module there must be a permanently marked “up” arrow to aid in the proper orientation of the module during installation.

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

**Physical and Mechanical Requirement**
LED signal modules must fit without modifications into existing traffic signal housings conforming to “Vehicle Traffic Control Signal Heads” (VTCSH) published in the Equipment and Materials Standards of the Institute of Transportation Engineers. The LED signal module must be a single, self-contained device, not requiring on-site assembly for installation. The LED signal assembly construction must conform to the applicable ASTM specifications for the materials used to fabricate the module. Each LED signal module must comprise a smooth surfaced Red, Yellow, or Green UV stabilized polycarbonate outer shell, multiple LED light sources, a power supply and a polycarbonate back cover assembled in a gasketted or silicon sealed unit.

**Optical and Light Output Requirement**
The minimum luminous intensity values and light output must be maintained within the rated input voltage of 117 Volts AC. LED signal modules must 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 warm-up time period at 100% duty cycle.
Electrical
The maximum wattage for 12 inch ball must be 20 Watts and 10 Watts for the 12 inch arrow. The LED sources must not be powered above 70% of the manufacturer’s specified rated load. This must be clearly shown in layman’s terms through calculations, schematics, catalogue cuts, etc. The LED sources must be made of the AlInGap type shown clearly in a catalogue cut or similar literature.

Warranty
The LED signal module will be replaced or repaired by the manufacturer if it exhibits a failure due to workmanship or material 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 40 percent light output degradation or a fall below the minimum intensity levels within the first 36 months of field operation.

Pedestrian Heads with Countdown Timers
All pedestrian heads must be 16 inch, single units, with countdown timers. Pedestrian head indications must be illuminated L.E.D. type displaying graphical symbols of a walking person and/or upraised hand. The countdown module must display the number of seconds beginning at the start of the flashing “DON’T WALK” interval, continue counting down through the flashing “DON’T WALK” interval, and blank out during the steady “DON’T WALK” interval. The countdown module must be automatically set by the intersection controller based upon the “WALK” and “DON’T WALK” signal intervals only. The countdown module must continuously monitor the intersection controller for any changes to the pedestrian phase timing, and reprogram itself automatically. All LED indications on the pedestrian signal must have an automatic dimming circuit for night illumination to reduce long-term degradation to the LEDs.

Pedestrian Push Buttons
Pedestrian push button controls must be raised from or flush with their housings and must be a minimum of 2 inches in the smallest dimension. The force required to activate the controls must be no greater than 5 pounds.

Pedestrian push buttons must be located as close as practicable to the sidewalk curb ramp serving the controlled crossing and must permit operation from a clear ground space. If two crosswalks, oriented in different directions, end at or near the same location, the positioning of pedestrian pushbuttons and/or legends on the pedestrian push button signs should clearly indicate which crosswalk signal is actuated by each pedestrian push button.

A maximum mounting height of 42 inches above the finish sidewalk grade must be used for pedestrian push buttons.

Post and Base
Signal posts and bases must be steel shafts with transformer bases.
Signal base foundations must not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons is impaired.

Software
All local controller, malfunction management unit, and software must be supplied with the latest available revision. Any software upgrades released by the manufacturer must be supplied at no charge to the Owner for a period of five years after acceptance of the traffic signal installations.

Data Base Programming
Each programmable local hardware component (i.e., controller, malfunction management unit, and preemption unit) must be initially programmed by the Contractor based on information contained on the plans.

Three sets of hard copy programming per device must be supplied by the Contractor.

Equipment Finish and Color
Traffic signal equipment including but not limited to signal posts, bases, signal heads, visors, doors, mast arms, pushbutton saddles, controller cabinet (outside), service meter socket box, hardware, and rigid mounting brackets for signals and signs must be colored Semi-Gloss Black, subject to the approval of the Town. The Contractor must submit to the Engineer, and Town for approval, paint chips and sample finishes on aluminum and steel of the intended color prior to any work being done under this heading.

Signal heads, doors, visors, mounting brackets, and hardware supplied direct from the manufacturer in the color stipulated above may be acceptable provided it meets or exceeds the finish process for the material indicated below.

Steel Equipment

**Galvanizing**
All bolts, screws, nuts, rods and washers must be galvanized in accordance with AASHTO M232 and the Standard Specifications. The hardened machine screws may be electroplate galvanized. Stainless steel studs, bolts, screws, nuts, straps and washers must not be galvanized. Galvanized hardware need not be painted; however, the ends of bolts, nuts, and washers must be painted in the field according to section “Touch-up and Repairs.”

Immediately prior to galvanizing, the steel must be immersed in a bath of zinc ammonium chloride. The dry kettle galvanizing process must be used.

All steel components, other than above, must be galvanized after fabrication in accordance with AASHTO M111. The galvanizing bath must contain nickel (0.05% to 0.09% by weight) in accordance with subsection 960.61 of the Standard Specifications.

Galvanized members requiring shop assembly must be welded and drilled prior to galvanizing.
Coating over Galvanized Steel
Prior to painting, the applicator must ensure that all components are smooth and without sharp protrusions that would present and injury hazard to pedestrians. Also, the fabricator must ensure that all welds must be cleaned thoroughly in accordance with good practice and according to AWD D1.5 and ASTM A123-89a and must have a suitable surface to accept the galvanizing.

In preparation for the two coat painting system, the surface must be blast cleaned in accordance with the requirements of SSPC SP7 “Brush-Off Blast Cleaning” or other method producing equivalent results and uniform profile, to achieve a 1.0 to 1.5 mils anchor profile as indicated be a Keane Tator profile comparator or similar device. The creation of the anchor profile must be performed prior to the formation of “white rust” on the galvanized surface.

Following blast cleaning, the zinc coating thickness must be measured to verify that the coating thickness is in accordance with AASHTO M111.

A two-coat painting system must be applied by the Galvanizer in his own facility within twelve hours of galvanizing the steel components.

The prime coat material must be a polyamide epoxy applied to minimum dry film thickness of 2.0 to 4.0 mils (0.002-0.004 in.) and force cured as given below for the finish coat.

The finish coat material must be a two component, catalyzed aliphatic urethane applied by airless spray to a minimum dry film thickness of 4.0 mils.

The color must be per the Semi-Gloss Black. The fabricator must submit to the Engineer for approval, paint chips of the intended color prior to any work being done under this heading.

All finish coat material must be applied under conditions within the following tolerances:

1. Air Temperature: 50 °F min., 90 °F max.
2. Surface Temperature: 50 °F min., 100 °F max.
3. Surface temperature must be at least 5°F above the dew point.

The finish coat must be cured in a booth capable of maintaining 150 °F for 2-4 hours.

Touch-up and Repairs
Should any damage occur to the galvanized coating during shipping or handling at the job site, the Contractor must repair and touch-up any damaged areas to the satisfaction of the Engineer and the following:

Touch-up of galvanizing before the finish coat is applied must be accomplished by applying galvanizing repair paint in accordance with Section M7.04.11. The dry film thickness of the applied repair paint must not be less than 4.0 mils.

Applications must be in accordance with the manufacturer’s instruction.

Field touch-up procedures must conform to the recommendations of the galvanizer. Touch-up of the finish coat must be by applying a coating of a two-part urethane, as
supplied by the Galvanizer, to achieve a dry film thickness of at least 4.0 mils. Prior to the application of the paint, remove all damaged coatings down to a solidly adhered coating and apply galvanizing repair paint as primer.

Allow the primer to dry for at least 4 hours prior to top coating.

The Contractor must also use the touch-up paint material and procedures to paint the galvanized hardware used in field erection that has not been finish coated previously.

**Aluminum Equipment**

All aluminum equipment called for must have a powder coat finish. The coating must be a polyester-TGIC (triglycidyl isocyanurat) resin system conforming to the following:

<table>
<thead>
<tr>
<th>Quality</th>
<th>Test</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion</td>
<td>Taber abraser CS-10, 1000 gram load, 1000 cycle, ASTM D4060</td>
<td>100 mg. Maximum weight loss</td>
</tr>
<tr>
<td>Adhesion</td>
<td>ASTM D 523</td>
<td>5A</td>
</tr>
<tr>
<td></td>
<td>Initial 1000 hours</td>
<td>5A</td>
</tr>
<tr>
<td>Gloss</td>
<td>ASTM D 523, 60° - 600 hours, 60° - 1000 hours</td>
<td>82% retention, 90% retention (washed)</td>
</tr>
<tr>
<td>Hardness</td>
<td>ASTM D 3363</td>
<td>2H – No Gouge</td>
</tr>
<tr>
<td>Impact</td>
<td>ASTM D 2794 Direct</td>
<td>Pass 80 inch-lb</td>
</tr>
<tr>
<td>Salt Spray Resistance</td>
<td>ASTM B 177, ASTM D 1654, 1000 hours unscribed, 400 hours scribed</td>
<td>Table 2-10, Table 1-10</td>
</tr>
<tr>
<td>Weather Resistant</td>
<td>ASTM G 23, 1000 hours, 18 min. waterspray, 102 min. light</td>
<td>No film failure</td>
</tr>
<tr>
<td>Color</td>
<td><strong>Semi-Gloss Black</strong></td>
<td></td>
</tr>
<tr>
<td>Identify</td>
<td>Infrared fingerprint</td>
<td>Match</td>
</tr>
<tr>
<td>Flexibility</td>
<td>180° bend; ½” dia, mandrel within 10 seconds</td>
<td>No breaks, flaking or cracks. Tested with a Q-panel with 2 mils or less of coating</td>
</tr>
</tbody>
</table>
Humidity | ASTM D 2247, 1000 hours | No blister or film failure
---|---|---
Thickness | 4 mils +/- 1 mils | 
Mar Resistance | Good | 

A Certificate of Compliance of the powder coating system is required for the Engineer’s approval.

**Item 852.1 – Temporary Pedestrian Management Guidance System**

Work under this item will consist of installing a system to guide pedestrians around closed sidewalk and curb ramp work locations and/or across the roadway as required.

Layout and materials must meet the requirements of the Americans with Disabilities Act (ADA) and the Massachusetts Architectural Access Board (MAAB) as well as the rules and regulations for temporary traffic control devices in the Manual on Uniform Traffic Control Devices (MUTCD). The system must have a continuous bottom rail or edge no more than two (2) inches above the ground and six (6) inches in height (minimum) to accommodate cane users, have a smooth and continuous top edge no less than 32 inches above the ground to facilitate “hand trailing” and not obstruct or project into the pedestrian path of travel. All elements of the pedestrian guidance system should be nearly vertical and generally within the same plane.

Elements of the system may include temporary portable pedestrian barricade (not temporary barrier), modular or pre-fab temporary curb ramps and associated modifications and appurtenances. The guidance system is to prevent pedestrians from entering the work area, or entering into vehicle travel lane and channelizing them in conformance with ADA/MAAB requirements.

The Contractor may use either modular/pre-fab temporary curb ramps to construct temporary ramps for pedestrian accommodation. Regardless of temporary ramp type, each location is required to have an approved Temporary Pedestrian Management Guidance System.

It is the intent of this Item to reuse the placed pedestrian guidance system in many locations. The contractor must maintain the integrity of the guidance system throughout the project duration. Special care must be taken by the Contractor removing and resetting of the guidance system not to damage any piece of the system. The system must remain in working order throughout construction. Any material that is damaged during the deployed period must be replaced at the direction of the Engineer at no additional cost.

The work under Item 852.1 will be paid for at the Contract lump sum price, which price will include all labor, material, equipment and incidental costs required to complete the work. There will be no compensation made for any damaged section. The removal, and the resetting/modifying of the pedestrian management system must be considered incidental to this item. The lump sum will be partially paid for throughout the project based upon construction staging operations.
Item 874.3 – Traffic Signs Removed and Disposed

The work under this item will conform to the relevant provisions of Section 828 of the Standard Specifications and the following:

The work will include the careful removal, transporting and stacking of signs, attached hardware and supports from locations shown on the plans and as directed by the Engineer. Signs, attached hardware and supports must be removed and disposed of by the Contractor, unless otherwise directed by the Engineer.

Signs, attachment hardware and sign support posts must be disposed of immediately following removal.

Any signs and posts damaged or lost either directly or indirectly as a result of the Contractor's operations must be replaced by the Contractor at no additional cost to the Owner. The Contractor must coordinate the removal of signs and posts with the Engineer by notifying the Engineer prior to and at the completion of the above work. Existing signs must remain in place until proposed new signs are in place.

The work will include Warning-Regulatory and Route Marker signs, and miscellaneous directional signs.
APPENDIX A – WAGE RATES

Note: Prevailing Wage Rates are available on the Town of Burlington website at: http://www.burlington.org under the “Business” drop-down menu.
APPENDIX B – PROJECT PLANS