

**DOCUMENT A00801**  
**SPECIAL PROVISIONS**  
**WESTFORD, CARLISLE AND ACTON**  
**Federal Aid Project Number:**

*Put-In Revised 01/10/2014*

**Construction of the Bruce Freeman Rail Trail (Phase 2A), Replacement of Bridge No. A-02-019 over Nashoba Brook, Replacement of Bridge No. A-02-027 over Nashoba Brook, Replacement of Bridge No. A-02-028 over Nashoba Brook, Replacement of Bridge No. A-02-032 over Nashoba Brook, Replacement of Bridge No. A-02-030 over Nashoba Brook, Replacement of Bridge No. A-02-031 over Butter Brook and Construction of Bridge over Great Road**

Labor participation goals for this project shall be 15.3% for minorities and 6.9% for women for each job category. The goals are applicable to both contractor's and subcontractor's on-site construction workforce. Refer to document 00820 for details.

### **SCOPE OF WORK**

The work under this Contract consists of the construction of a paved multi-use trail in the Towns of Westford, Carlisle and Acton along the former Lowell Secondary railroad line owned by the Commonwealth of Massachusetts. Phase 2A of the project begins at the termination of Phase 1 at the intersection of Route 225 and Route 27 in Westford and heads southerly approximately 700 feet where it intersects the Carlisle town line. The trail then continues southerly for approximately 850 feet through Carlisle to the Acton town line. From there, the proposed trail continues southerly through Acton for a distance of approximately 4.5 miles to a point 1,000 feet south of Wetherbee Street, behind Teamworks Acton (located at 30 Great Road in Acton).

The work includes clearing and grubbing, track removal, earth excavation, full depth hot mix asphalt pavement, drainage improvements, fence installation, retaining wall construction, six bridge decks, one new prefabricated bridge over Route 2A/119 in the Town of Acton, parking lots, landscaping and trail amenities, installation of rectangular rapid flash beacons, traffic signing and pavement markings, traffic control management, and other street improvements.

The work also consists of the installation of a traffic signal system at one (1) location, complete with vehicle detectors, signal posts, signal heads, cabinet, foundations, pull boxes, service connections, and all other equipment, materials and incidental costs necessary to furnish, install and program a complete and functioning traffic control signal system as specified and as shown in the contract documents.

All work under this contract shall be done in conformance with the Massachusetts Highway Department *Standard Specifications for Highways and Bridges* dated 1988, the *Supplemental Specifications* dated June 15, 2012, and the *Interim Supplemental Specifications* contained in this book; the *2012 Construction Standard Details*, the *1990 Standard Drawings for Signs and Supports*; the *2009 Manual on Uniform Traffic Control Devices (MUTCD)* with *Massachusetts Amendments* and the *Standard Municipal Traffic Code*; the *1968 Standard Drawings for Traffic Signals and Highway Lighting*; the latest edition of *American Standard for Nursery Stock*; the *Plans* and these *Special Provisions*.

## **CONTRACTOR QUESTIONS AND ADDENDUM ACKNOWLEDGEMENTS**

Prospective bidders are required to submit all questions to the Construction Contracts Engineer by 1:00 P.M. on the Thursday before the scheduled bid opening date. Any questions received after this time will not be considered for review by the Department.

Contractors should email questions and addendum acknowledgements to the following email address [massdot-specifications@dot.state.ma.us](mailto:massdot-specifications@dot.state.ma.us). Please put the MassDOT project file number and municipality in the subject line.

## **MASSHIGHWAY TO MASSDOT NAME CHANGE**

The following definitions in Section 100 of the Standard Specifications for Highways and Bridges are revised as follows:

(Amend definition of Department)

- 1.17 –Department .....Effective November 1, 2009, St. 2009, c. 25 abolishes the Massachusetts Department of Highways and all assets, liabilities, and obligations become those of the Massachusetts Department of Transportation (“MassDOT). Anywhere in this contract the terms Commission, Commonwealth, Department of Public Works, Department, Massachusetts Highway Department, MassHighway, Party of the First Part, or any other term intending to mean the former Massachusetts Department of Highways is used, it shall be interpreted to mean MassDOT or applicable employee of MassDOT unless the context clearly requires otherwise. Furthermore, MassDOT by operation of law inherited all rights and obligations pursuant to any contract, and therefore parties to this contract hereby acknowledge and agree that its terms shall be liberally construed and interpreted to maintain the rights and obligations of MassDOT. Furthermore, the parties hereby acknowledge and agree that the transfer of all rights and obligations from the Massachusetts Department of Highways to MassDOT shall not have the effect of altering or eliminating any provision of this contract in a manner that inures to the detriment of MassDOT.

(Add a definition for MassDOT)

- 1.46 – MassDOT.....The Massachusetts Department of Transportation, a body politic and corporate, under St. 2009, c. 25 “An Act Modernizing the Transportation Systems of the Commonwealth”, as amended.

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## **ENGINEERING DIRECTIVES**

Contractors can access MassDOT, Highway Division Engineering Directives at:

<http://www.mass.gov/massdot/highway>

Select Doing business with us

Select Design/Engineering

Select Engineering & Policy Directives

Select Engineering Directives

## **CONTRACTOR/SUBCONTRACTOR CERTIFICATION – CONTRACT COMPLIANCE**

(Revision 03-23-10)

Pursuant to 23 C.F.R. § 633.101 *et seq.*, the Federal Highway Administration requires each contractor to “insert in each subcontract, except as excluded by law or regulation, the required contract provisions contained in Form FHWA–1273 and further requires their inclusion in any lower tier subcontract that may in turn be made. The required contract provisions of Form FHWA–1273 shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the requirements contained in the provisions of Form FHWA–1273.” The prime contractor shall therefore comply with the reporting and certification requirements provided in MassDOT’s CONTRACTOR/SUBCONTRACTOR CERTIFICATION Form (DOT-DIST-192) certifying compliance with 23 C.F.R. § 633.101 for each subcontract agreement entered into by the contractor. The contractor shall provide a fully executed original copy of said CONTRACTOR/SUBCONTRACTOR CERTIFICATION Form to MassDOT upon execution of any subcontract agreement. Failure to comply with the reporting and certification requirement of the CONTRACTOR/SUBCONTRACTOR CERTIFICATION Form may result in action against the prequalification status of the prime contractor with MassDOT.

## **SUBSECTION 4.04 CHANGED CONDITIONS.**

This Subsection is revised by deleting the two sequential paragraphs near the end that begin “The Contractor shall be estopped...” and “Any unit item price determined ...” (1/6/2006).

## **NHESP HABITAT FOCUS AREAS**

Natural Heritage and Endangered Species Program (NHESP) has identified three priority habitat focus areas within the project limits. Focus Area 1 is located from Station 143+50 to 602+00. Focus Area 2 is located from Station 188+50 to 195+00 and 203+00 to 225+00. Focus Area 3 is located from Station 55+75 to 68+00. All three are labeled on the plans.

The Contractor is alerted to the fact that no stockpiling, staging or access is allowed within the NHESP Habitat Focus Areas.

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**SUBSECTION 8.10 DETERMINATION AND EXTENSION OF CONTRACT TIME FOR COMPLETION (TIME EXTENSIONS)**

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Replace this Subsection with the following:

**A. General**

It is an essential part of all contracts that contractors shall perform the Work fully, entirely and in an acceptable manner within the contract duration.

The contract duration is based upon the requirements of public convenience and the assumption that the Contractor will prosecute the Work efficiently and with the least possible delay, in accordance with the maximum allowable working time, as specified in the Contract.

The contract duration has been carefully considered and has been established for reasons of importance to the Department. The contract duration will be enforced and it is understood that the Contractor accepted this concept at the time of the submission of the bid. The timing of the Notice to Proceed (NTP) has been taken into account in the determination of the contract duration and the timing of the issuance of the NTP shall not, by itself, be a reason for a time extension.

An extension of contract time will be granted only if entitlement to a time extension has been clearly demonstrated to the satisfaction of the Engineer by a documented time entitlement analysis, performed in accordance with the requirements of Subsection 8.02.E.8 - Time Entitlement Analysis.

**B. Requests for Additional Contract Time (Time Extensions)**

In response to a request for a time extension, an extension of contract time may be granted for demonstrated delays resulting from only one, or, in the case of concurrent delays, a combination of the following causes:

**1. Extra Work**

Each extra work order (EWO) proposal shall include an evaluation of the impact of the EWO on contract time, expressed in calendar days. If there is no impact to the contract time as a result of the EWO, the EWO shall indicate this by stating that zero (0) calendar days of additional time is being requested. The need for a time extension as a result of the EWO must be clearly demonstrated by a documented time entitlement analysis (TEA) performed by the Contractor in accordance with the requirements of Subsection 8.02.E.8. A documented preliminary TEA supporting the EWO proposal shall be submitted to the Engineer as part of the EWO proposal. Also see Subsection 4.03 – Extra Work and Subsection 4.05 – Validity of Extra Work.

**2. Department-Caused Delays**

If any part of the Work is delayed or suspended by the Department, the Contractor will be granted a time extension to complete the Work or any portion of the Work only if entitlement to this time extension has been clearly demonstrated by a documented time entitlement analysis. Department-caused delays shall not include delays to or suspensions of the Work that result from the fault or negligence of the Contractor. Also see Subsection 8.05 – Claim for Delay or Suspension of the Work.

### 3. Increased Quantities

Increased quantities of work may be considered as the basis for a time extension only if the requirements of Subsection 4.06 - Increased or Decreased Contract Quantities are met. The time allowed for performance of the Work will be increased based on increased quantities only if entitlement to this time extension has been clearly demonstrated by a documented time entitlement analysis. A decrease in quantities shall also require a time entitlement analysis to determine if a deduction of contract time is warranted.

### 4. Delays Not Caused by Contractor Fault or Negligence

When delays occur due to reasonable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to: “Acts of God”; war, whether or not declared, civil war, insurrection, rebellion or revolution, or to any act or condition incident to any of the foregoing; acts of the Government; acts of the State or any political subdivision thereof; acts of other contracting parties over whose acts the Contractor has no control; fires; floods; epidemics; abnormal tides (not including Spring tides); severe coastal storms accompanied by high winds or abnormal tides; freezing of streams and harbors; abnormal time of Winter freezing or Spring thawing; interference from recreational boat traffic; use of beaches and recreational facilities for recreational purposes during the Summer season; abnormal ship docking and berthing; unanticipated use of wharves and storage sheds; strikes, except those caused by improper acts or omissions of the Contractor; extraordinary delays in delivery of materials caused by strikes, lockouts, wrecks, and/or freight embargoes; a time extension will be granted only if entitlement to a time extension has been clearly demonstrated by a documented time entitlement analysis.

An “Act of God” as used in this subsection is construed to mean an earthquake, flood, cyclone, hurricane, tornado, or other cataclysmic phenomenon of nature beyond the power of the Contractor to foresee and/or make preparations against. Additional consideration may be given to severe, abnormal flooding in local rivers and streams that has been reported as such by the National Weather Service. Rain, wind, snow, and/or other natural phenomena of normal intensity, based on National Weather Service reports, for the particular locality and for the particular season of the year in which the Work is being prosecuted, shall not be construed as an “Act of God” and no time extension will be granted for the delays resulting therefrom.

Within the scope of acts of the Government, consideration will be given to properly documented evidence that the Contractor has been delayed in obtaining any material or class of labor because of any assignment of preference ratings by the Federal Government or its agencies to defense contracts of any type.

### 5. Delays Caused by Public Service Corporations, Municipal Departments or Other Third Parties

If any part of the Work is delayed by public service corporations, municipal departments or other third parties, a time extension will be granted only if entitlement to a time extension has been clearly demonstrated by a documented time entitlement analysis. Also see Subsections 5.05 - Cooperation by Contractor, 5.06 - Adjacent Contracts and 8.04 - Removal or Demolition of Buildings and Land Takings.

### **C. Time Extension Determination**

1. When the Contractor submits a request for a time extension, placing the Department on notice of a delay due to any of the causes listed in Subsection 8.10.B, it shall be submitted in writing to the Engineer within fifteen (15) calendar days after the start of the delay. No time extension will be granted if a request for a time extension is not filed within fifteen (15) calendar days after the start of the delay.

A documented preliminary time entitlement analysis (TEA) supporting the request for a time extension and meeting the requirements of Subsection 8.02.E.8 shall be submitted to the Engineer no later than fifteen (15) calendar days after the request for a time extension is submitted to the Engineer or thirty (30) calendar days after the start of the delay. A documented final TEA shall be submitted to the Engineer no later than fifteen (15) calendar days after the end of the delay. During the time between the preliminary and final TEAs, the delay shall be documented in statused contract progress schedules submitted in accordance with the requirements of Subsection 8.02.E.5.

2. No time extension will be granted for any delay or any suspension of the Work due to the fault of the Contractor.

3. No time extension will be granted if the request for a time extension is based on any claim that the originally established contract duration was inadequate.

4. Time extensions will only be granted for delays, including concurrent delays, to activities affecting contract milestones, the contract completion date and/or other critical path activities as demonstrated to the satisfaction of the Engineer by a detailed time entitlement analysis that clearly states the number of calendar days of extra time being requested.

5. The probable slowdown or curtailment of work during inclement weather and winter months has been taken into consideration in determining the contract duration and therefore no time extension will be granted, except as defined in Subsection 8.10.B.4.

6. Any work restriction related to weather, permit conditions, community accommodation, traffic or any other restriction specified in the Contract or reasonably expected for the particular locality and for the particular season of the year in which the Work is being prosecuted must be considered in the analysis of each individual time extension and shall not be considered, in itself, justification for an extension of time.

7. Any time entitlement analysis prepared for the purpose of requesting a time extension shall clearly indicate any proposed overtime hours or additional shifts that are incorporated in the schedule. The Engineer shall have final approval over the use of overtime hours and additional shifts and shall have the right to require that overtime hours and/or additional shifts be used to minimize the duration of time extensions if it is determined to be in best interest of the Department to do so.

### **D. Disputes**

Any dispute regarding whether or not a time entitlement analysis demonstrates entitlement to a time extension, the number of days granted in a time extension or any other question of fact arising under this subsection shall be determined by the Engineer.

The Contractor may dispute a determination by the Engineer by filing a claim notice within fourteen (14) calendar days after the Contractor's request for additional time has been denied or if the Contractor does not accept the number of days granted in a time extension. The Contractor's claim notice shall include a time entitlement analysis that sufficiently explains the basis of the time-related claim. Failure to submit the required time entitlement analysis with the claim notice shall result in denial of the Contractor's claim.

#### **SUBSECTION 4.03 EXTRA WORK (Also see Subsection 4.05)**

The Contractor shall do any work not herein otherwise provided for when and as ordered in writing by the Engineer, such written order to contain particular reference to this Subsection and to designate the work to be done as Extra Work.

Unless specifically noted in the Extra Work Order, Extra Work will not extend the time of completion of the Contract as stipulated in Subsection 8.10.

The determination of the Engineer shall be final upon all questions concerning the amount and value of Extra Work (except as provided in Subsection 7.16).

Payment for Extra Work will be provided in Subsection 9.03.

#### **SUBSECTION 8.14 UTILITY COORDINATION, DOCUMENTATION, AND MONITORING RESPONSIBILITIES**

##### **A. GENERAL**

In accordance with the provisions of Section 8.00 Prosecution and Progress, utility coordination is a critical aspect to this Contract. This section defines the responsibility of the Contractor and MassDOT, with regard to the initial utility relocation plan and changes that occur as the prosecution of the Work progresses. The Engineer, with assistance from the Contractor shall coordinate with Utility companies that are impacted by the Contractor's operations. To support this effort, the Contractor shall provide routine and accurate schedule updates, provide notification of delays, and provide documentation of the steps taken to resolve any conflicts for the temporary and/or permanent relocations of the impacted utilities. The Contractor shall provide copies to the Engineer of the Contractor communication with the Utility companies, including but not limited to:

- Providing advanced notice, for all utility-related meetings initiated by the Contractor.
- Providing meeting minutes for all utility-related meetings that the Contractor attends.
- Providing all test pit records.
- Request for *Early Utility* work requirements of this section (see below).
- Notification letters for any proposed changes to Utility start dates and/or sequencing.
- Written notification to the Engineer of all apparent utility delays within seven (7) Calendar Days after a recognized delay to actual work in the field – either caused by a Utility or the Contractor.
- Any communication, initiated by the Contractor, associated with additional Right-of-Way needs in support of utility work.
- Submission of completed Utility Completion Forms.

## B. PROJECT UTILITY COORDINATION (PUC) FORM

The utility schedule and sequence information provided in the Project Utility Coordination Form (if applicable) is the best available information at the time of the bid and has been considered in setting the contract duration. The Contractor shall use all of this information in developing the bid price and the Baseline Schedule Submission, inclusive of the individual utility durations sequencing requirements, and any work that has been noted as potentially concurrent utility installations.

## C. INITIATION OF UTILITY WORK

The Engineer will issue all initial notice-to-proceed dates to each Utility company based on either the:

- 1) Contractor's accepted Baseline Schedule
- 2) An approved Early Utility Request in the form of an Early Utility sub-net schedule (in accordance with the requirements of this Subsection)
- 3) An approved Proposal Schedule

### C.1 - BASELINE SCHEDULE – UTILITY BASIS

The Contractor shall provide a Baseline Schedule submission in accordance with the requirements of Subsection 8.02 and inclusive of all of the information provided in the PUC Form that has been issued in the Contract documents. This is to include the utility durations, sequencing of work, allowable concurrent work, and all applicable considerations that have been depicted on the PUC Form.

### C.2 – EARLY UTILITY REQUEST – (aka SUBNET SCHEDULE) PRIOR TO THE BASELINE

All early utility work is defined as any anticipated/required utility relocations that need to occur prior to the Baseline Schedule acceptance. In all cases of proposed early utility relocation, the Contractor shall present all known information at the pre-construction conference in the form of a 'sub-net' schedule showing when each early utility activity needs to be issued a notice-to-proceed. The Contractor shall provide advance notification of this intent to request early utility work in writing at or prior to the Pre-Construction meeting. Prior to officially requesting approval for early utility work, the Contractor shall also coordinate with MassDOT and all utility companies (private, state or municipal) which may be impacted by the Contract. If this request is acceptable to the Utilities and to MassDOT, the Engineer will issue a notice-to-proceed to the affected Utilities, based on these accepted dates.



### C.3 – PROPOSAL SCHEDULE - CHANGES TO THE PUC FORM

If the Contractor intends to submit a schedule (in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02) that contains durations or sequencing that vary from those provided in the Project Utility Coordination (PUC) Form, the Contractor must submit this as an intended change, in the form of a Proposal Schedule and in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02. These proposed changes are subject to the approval of the Engineer and the impacted utilities, in the form of this Proposal Schedule and a proposed revision to the PUC form. The Contractor shall not proceed with any changes of this type without written authorization from the Engineer, that references the approved Proposal Schedule and PUC form changes. The submission of the Baseline Schedule should not include any of these types of proposed utility changes and should not delay the submission of the Baseline Schedule. As a prerequisite to the Proposal Schedule submission, and in advance of the utility notification(s) period, the Contractor shall coordinate the proposed utility changes with the Engineer and the utility companies, to develop a mutually agreed upon schedule, prior to the start of construction.

### D. UTILITY DELAYS

The Contractor shall notify the Engineer upon becoming aware that a Utility owner is not advancing the work in accordance with the approved utility schedule. Such notice shall be provided to the Engineer no later than seven (7) calendar days after the occurrence of the event that the Contractor believes to be a utility delay. After such notice, the Engineer and the Contractor shall continue to diligently seek the Utility Owner's cooperation in performing their scope of Work.

In order to demonstrate that a critical path delay has been caused by a third-party Utility, the Contractor must demonstrate, through the requirements of the monthly Progress Schedule submissions and the supporting contract records associated with Subsection 8.02, 8.10 and 8.14, that the delays were beyond the control of the Contractor.

All documentation provided in this section is subject to the review and verification of the Engineer and, if required, the Utility Owner. In accordance with MassDOT Specifications, Division I, Subsection 8.10, a Time Extension will be granted for a delay caused by a Utility, only if the actual duration of the utility work is in excess of that shown on the Project Utility Coordination Form, and only if;

- 1) proper Notification of Delay was provided to MassDOT in accordance with the time requirements that are specified in this Section
- 2) the utility delay is a critical path impact to the Baseline Schedule (or most recently approved Progress Schedule)

### E. LOCATION OF UTILITIES

The locations of existing utilities are shown on the Contract drawings as an approximation only. The Contractor shall perform a pre-construction utility survey, including any required test pits, to determine the location of all known utilities no later than thirty (30) calendar days before commencing physical site work in the affected area.

**F. POST UTILITY SURVEY – NOTIFICATION**

Following completion of a utility survey of existing locations, the Contractor will be responsible to notify the Engineer of any known conflicts associated with the actual location of utilities prior to the start of the work. The Engineer and the Contractor will coordinate with any utility whose assets are to be affected by the Work of this Contract. A partial list of utility contact information is provided in the Project Utility Coordination Form.

**G. MEETINGS AND COOPERATION WITH UTILITY OWNERS**

The Contractor shall notify the Engineer in advance of any meeting they initiate with a Utility Owner's representative to allow MassDOT to participate in the meeting if needed.

Prior to the Pre-Construction Meeting, the Contractor should meet with all Utility Owners who will be required to perform utility relocations within the first 6 months of the project, to update the affected utilities of the Project Utility Coordination Form and all other applicable Contract requirements that impact the Utilities. The Contractor shall copy the Engineer on any correspondence between the Utility Owner and the Contractor.

**H. FORCE ACCOUNT / UTILITY MONITORING REQUIREMENTS**

The Engineer will be responsible for recording daily Utility work force reports. The start, suspension, re-start, and completion dates of each of the Utilities, within each phase of the utility relocation work, will be monitored and agreed to by the Engineer and the Contractor as the work progresses.

**I. ACCESS AND INSPECTION**

The Contractor shall be responsible for allowing Utility owners access to their own utilities to perform the relocations and/or inspections. The Contractor shall schedule their work accordingly so as not to delay or prevent each utility from maintaining their relocation schedule.

**PROTECTION OF UNDERGROUND FACILITIES**

The Contractor's attention is directed to the necessity of making his own investigation in order to assure that no damage to existing structures, drainage lines, traffic signal conduits, etcetera, will occur.

The Contractor shall notify Massachusetts DIG SAFE and procure a Dig Safe Number for each location prior to disturbing existing ground in any way. The telephone number of the Dig Safe Call Center is 811 or 1-888-344-7233.

**DISPOSAL OF EXCESS MATERIAL**

Surplus materials obtained from any type of excavation, and all existing and other materials not required to be removed and stacked or needed for use on the project, as determined by the Engineer, shall become the property of the Contractor and disposed of subject to the regulations and requirements of local authorities governing the disposal of such materials, at no additional compensation.

**SHOP DRAWING SUBMITTALS** (Replace Subsection 5.02, 8th paragraph)

The Contractor shall submit two sets of full-scale shop drawing prints to the Engineer for approval. If corrections are required, one set of the marked-up drawings will be returned to the Contractor for revision and subsequent re-submittal. The Engineer shall make all copies of the approved shop drawings as indicated in Table 1 of Subsection 5.02 and will distribute the drawings. No changes shall be made to the approved drawings without the written consent of the Engineer.

Required shop drawing submittals will include but are not limited to the following items:

Item 655.01	Timber Rail Fence
Item 655.02	Timber Rail Fence on Bridge
Item 655.03	Timber Rail Post – 54” Tall
Item 656.	Remove and Reset Electric Gate and Equipment
Item 660.010	Railings
Item 665.3	72 Inch Stockade Fence
Item 673.	Steel Pipe Access Gate
Item 706.38	Granite Pier
Item 707.1	Park Bench
Item 707.7	Display Board
Item 707.81	Removable Bollard
Item 707.9	Bicycle Rack
Item 710.8	Granite Marker
Item 995.01	Bridge Structure, Bridge No. A-02-014 (A5T)
Item 995.011	Culvert Structure, Culvert No. A-XX-XXX
Item 996.31	Mechanically Stabilized Earth Wall
Item 996.4	Prefabricated Concrete Modular Gravity Wall

**DESIGNER/PROJECT MANAGER**

DESIGNER  
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978-570-2980

PROJECT MANAGER  
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**PROCEDURE FOR RELEASING AUTOCAD FILES TO THE GENERAL CONTRACTOR**

After the bid opening the low bidder may submit the Request for Release of MassDOT AutoCAD Files Form to the Highway Design Engineer. When the Highway Design Section has received both the AutoCAD files from the designer and the Request for Release of MassDOT AutoCAD Files Form from the Contractor, Highway Design will email the contractor a link through Dropbox.com with a reminder disclaimer of use (copy to Project Manager and District Construction Engineer).

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**HOLIDAY WORK RESTRICTIONS FOR CALENDAR YEAR 2014**

(Supplementing Subsection 7.09)

The District Highway Director may authorize work to continue during these specified time periods if it is determined by the District that the work will not negatively impact the traveling public.

Below are the holiday work restrictions for the calendar year 2014:

**New Years Day (Federal Holiday)**

Wednesday January 1, 2014:

No work on major arterial roadways from noon on Tuesday December 31, 2013 until the normal start of business on Thursday January 2, 2014. No work on local roadways on the holiday without permission by the DHD and the local police chief.

**Martin Luther King's Birthday (Federal Holiday)**

Monday January 20, 2014:

No work restrictions due to traffic concerns however work on local roadways requires permission by the DHD and local police chief.

**President's Day (Federal Holiday)**

Monday February 17, 2014:

No work restrictions due to traffic concerns however work on local roadways requires permission by the DHD and local police chief.

**Evacuation Day (Suffolk County State Holiday)**

Monday March 17, 2014:

No work restrictions due to traffic concerns.

**Patriot's Day (State Holiday)**

Monday April 21, 2014:

Work restrictions will be in place for Districts 3, 4 and 6 along the entire Boston Marathon route and any other locations that the DHD in those districts determine are warranted so as to not to impact the marathon.

All other districts work restrictions will be as per DHD.

**Memorial Day (Federal Holiday)**

Monday May 26, 2014:

No work on major arterial roadways from noon on Friday May 23, 2014 until the normal start of business on Tuesday, May 27, 2014.

**Bunker Hill Day (Suffolk County State Holiday)**

Tuesday June 17, 2014:

No work restrictions due to traffic concerns.

**Independence Day (Federal Holiday)**

Friday July 4, 2014:

No work on major arterial roadways from noon on Thursday July 3, 2014 until the normal start of business on Monday July 7, 2014.

Labor Day (Federal Holiday)

Monday September 1, 2014:

No work on major arterial roadways from noon on Friday August 29, 2014 until the normal start of business on Tuesday, September 2, 2014.

Columbus Day (Federal Holiday)

Monday October 13, 2014:

No work on major arterials from noon time on Friday, October 10, 2014 until the normal start of business on Tuesday, October 14, 2014. DHD may allow work in those areas on a case by case basis and where work is behind barrier and will not impact traffic.

Veterans' Day (Federal Holiday)

Tuesday November 11, 2014:

No work restrictions due to traffic concerns.

Thanksgiving Day (Federal Holiday)

Thursday November 27, 2014:

No work on major arterials from noon on Wednesday November 26, 2014 until the normal start of business on the Monday December 1, 2014.

Christmas Day (Federal Holiday)

Thursday December 25, 2014:

No work on major arterial roadways from noon on Wednesday December 24, 2014 until the normal start of business on Friday December 26, 2014.

**PROMPT PAYMENT AND RELEASE OF RETAINAGE TO SUBCONTRACTORS**

Contractors are required to promptly pay Subcontractors under this Prime Contract within ten (10) business days from the receipt of each payment the Prime Contractor receives from MassDOT. Failure to comply with this requirement may result in the withholding of payment to the Prime Contractor until such time as all payments due under this provision have been received by the Subcontractor(s) and/or referral to the Prequalification Committee for action which may affect the Contractor's prequalification status. The Contractor further agrees to make payment in full, including Retainage, to each Subcontractor no later than ten (10) business days after the Subcontractor has completed all of the work required under its subcontract.

**MASSDOT HIGHWAY DIVISION CONSTRUCTION SECTION**  
**SOP CSD 27-20-2-000 ATTACHMENT A**  
**LANGUAGE FOR SUBCONTRACTOR COMPLETION**  
**TO BE ADDED TO SUBCONTRACTOR APPROVAL PAPERWORK**  
**ISSUED SEPTEMBER 2, 2013**

Consistent with the Special Provisions section titled Prompt Payment and Release of Retainage to Subcontractors and State and Federal prompt payment regulations; 49 CFR Part 26.29 and MGL Chapter 30, Section 39F, the Contractor and Subcontractor are reminded that upon successful completion of the Subcontractor's work, all retainage held by the Prime Contractor must be returned to the Subcontractor, regardless of the status of the contract work as a whole.

The Subcontractor must notify the Contractor and MassDOT in writing that the Subcontractor has completed all of its work scope and request a final inspection of the work and release of retainage.

The Contractor may, in turn, request in writing that the Department also conduct an inspection of the Subcontractor's work before the Contractor releases retainage to the Subcontractor. The request must include a certification by the Contractor that the Subcontractor's work is complete and in conformance with the terms and conditions of the MassDOT contract.

If the Contractor decides for any reason that the retainage should not be released to the Subcontractor, the Contractor must notify MassDOT in writing what those reasons are, in sufficient detail for MassDOT to determine whether the Contractor's decision is appropriate.

If the Department has held retainage on the Subcontractor's work, and the Contractor wishes to have the retainage released, the Contractor must submit in writing a request to MassDOT for inspection of the work and release of retainage on the Subcontractor's work. The request must include a certification by the Contractor that the Subcontractor's work is complete and in conformance with the terms and conditions of the MassDOT contract. Retainage released by MassDOT for a Subcontractor's completed work shall be promptly passed on to the Subcontractor in accordance with the Prompt Payment provisions.

Upon receipt of full payment by the Subcontractor, the Subcontractor shall promptly record in the EBO system that full payment has been received.

The Contractor and Subcontractor are directed to the following: Division I, Section 9.02 Scope of Payments, 2nd paragraph, which provides that the release of retainage shall not constitute acceptance of the work and that any defects found before the Final Acceptance of the work shall be corrected at no cost to the Department. Division I, Section 5.09 Inspection of Work, 7th paragraph, which provides that inspection of the work shall not relieve the Contractor of any obligations to fulfill the terms of the contract.

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**BIDDERS LIST**

Pursuant to the provisions of 49 CFR Part 26.11 all official bidders will be required to report the names, addresses and telephone numbers of all firms that submitted bids or quotes in connection with this project. Failure to comply with a written request for this information within 15 business days may result in a recommendation to the Prequalification Committee that prequalification status be suspended until the information is received.

The Department will survey all firms that have submitted bids or quotes during the previous year prior to setting the annual goal and shall request that each firm report its age and gross receipts for the year.

**BUY AMERICA PROVISIONS (23 CFR 635.410)**

(Supplementing Subsection 6.01 Source of Supply and Quality)

Federal law 23 CFR 635.410 requires that all manufacturing processes, including application of the coating, for steel and iron materials to be permanently incorporated in Federal-aid highway construction projects must occur in the United States. Coating includes all processes which protect or enhance the value of a material to which the coating is applied.

Foreign steel and iron may be used if the cost of the materials as they are delivered to the jobsite does not exceed 0.1% of the total contract cost or \$2,500 whichever is greater.

**PRECAUTIONS UNDER ELECTRIC LINES**

The Contractor shall adhere to all requirements established by Occupational Safety and Health Administration (OSHA). The Contractor's attention is directed to the Code of Federal Regulations Part 1926 – *Safety and Health Regulations for Construction*, Subpart CC, 1926.140, relating to construction equipment clearances at overhead electric lines.

For the protection of personnel and equipment, the Contractor shall be aware of this regulation especially construction operations using large equipment. Particular attention should be paid to these requirements at Station 13+00, Station 47+40, Station 170+50, Station 188+75, and Station 248+40.

**NOTICE TO OWNERS OF UTILITIES** (Supplementing Subsection 7.13)

Written notice shall 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 of his intention to commence operations affecting such utilities at least one week in advance of the commencement of such operations. The Contractor shall, at the same time, file a copy of such notice with the Engineer. It is the Contractor's responsibility to provide adequate notice to all public and private utilities that may be affected by the construction of the project.

The following are the names of owners of the principal utilities affected as well as other major contacts, but completeness of this list is not guaranteed:

**Electric Company**

NStar Electric (Carlisle and Acton)

One NSTAR Way, SUM SE 310

Contact: Steven Owens

Westwood, MA 02090

(781) 441-8180

National Grid (Westford)

40 Sylvan Road, Floor E3.741

Contact: Michael Mokey

Waltham, MA 02451

(781) 907-3527

**Gas Company**

National Grid Gas

40 Sylvan Road, 3<sup>rd</sup> Floor W3.244

Contact: Melissa Owens

Waltham, MA 02451

(781) 907-2845

Tennessee Gas Pipeline Company

8 Anngina Drive

Contact: David Wood

Enfield, CT 06082

(860) 763-6005

**Telephone Company**

Verizon

1166 Shawmut Avenue

Contact: Karen Nunes

New Bedford, MA 02746

(508) 991-3522

**Water**

Westford Water Department (Westford)

60 Forge Village Road

Contact: Steven Cronin

Westford, MA 01886

(978) 692-5529

Acton Water District (Acton)

P.O. Box 953

Contact: Chris Allen

Acton, MA 01720

(978) 263-9107

Concord Water and Sewer Division (Acton)

135 Keyes Road

Contact: Alan Cathcart

Concord, MA 01742

(978) 318-3250



**Sewer**

Acton Health Department (Acton)  
472 Main Street  
Contact: Doug Halley

Acton, MA 01720  
(978) 264-9634

**Railroad**

PanAm Railways (Westford)  
Iron Horse Park  
Contact: John Steiniger

North Billerica, MA 01862  
(978) 663-6961

MBTA (Acton)  
500 Arborway  
Contact: Christine Bresnahan

Boston, MA 02130  
(617) 222-3361

**Cable Company**

Comcast (Westford, Acton)  
676 Island Pond Road  
Contact: Jean MacLaren

Manchester, NH 03109  
(603) 695-1461

MassDOT Fiber/Telcom (Westford)  
10 Park Plaza – Rm 4470  
Office of Real Estate and Asset Development  
Contact: Martin Polera

Boston, MA 02116  
(617) 248-2974

AT&T/TCG, c/o Siena Engineering (Westford, Acton)  
50 Mall Road, Suite 203  
Contact: David Edgar

Burlington, MA 01803  
(781) 221-8400, X 7005

NStar Communications (Carlisle, Acton)  
One NStar Way, NE 220  
Contact: Andrew Balta

Westwood, MA 02090  
(781) 441-3492

**Fire Alarm**

Carlisle Fire Department (Carlisle)  
P.O. Box 575  
Contact: David Flannery

Carlisle, MA 01741  
(978) 369-2242

Acton Fire Alarm (Acton)  
371 Main Street  
Contact: Ken Ineson

Acton, MA 01720  
(978) 264-9645

**Department Of Public Works**

Westford Town Engineer  
28 North Street  
Contact: Paul Starratt

Westford, MA 01886  
(978) 692-5520

Carlisle Department of Public Works  
P.O. Box 149  
Contact: Gary Davis

Carlisle, MA 01741  
(978) 369-6156

Acton Town Engineer  
472 Main Street  
Contact: Corey York

Acton, MA 01720  
(978) 264-9628

**Other**

MCI Metro Access (Westford, Acton)  
P.O. Box 600  
Contact: Stephen Parretti

Charlton, MA 01507  
(508) 248-1305

Lighttower (Westford)  
80 Central Street  
Contact: Evan Spitzer

Boxborough, MA 01719  
(978) 264-6022

**ROADWAY FLAGGER**

(Supplementing Subsection 4.06)

MassDOT reserves the right to provide certified Roadway Flaggers who are MassDOT employees, at the discretion of the Engineer. The Contractor shall not be charged nor compensated for the use of MassDOT employee flaggers. Should the substitution of MassDOT employee flaggers result in the elimination or reduction of payable hours for Item 850.41 Roadway Flagger, the provisions of Section 4.06 Increased or Decreased Contract Quantities shall not apply. This item shall not be subject to renegotiation for any reason under Section 4.06 regardless of whether or not this item overruns or underruns.

**ARCHITECTURAL ACCESS BOARD TOLERANCES**

The Contractor is hereby notified that they are ultimately responsible for constructing all project elements in strict compliance with the current AAB/ADA rules, regulations and standards.

All construction elements in this project associated with sidewalks, walkways, wheelchair ramps and curb cuts are controlled by 521CMR - Rules and Regulations of the Architectural Access Board (AAB).

The AAB Rules and Regulations specify maximum slopes and minimum dimensions required for construction acceptance. There is no tolerance allowed for slopes greater than the maximum slope nor for dimensions less than the minimum dimensions.

Contractors shall establish grade elevations at all wheel chair ramp locations, and shall set transition lengths according to the appropriate table in the Construction Standards (or to the details shown on the plans).

All wheelchair ramp joints and transition sections which define grade changes shall be formed, staked and checked prior to placing cement concrete. All grade changes are to be made at joints.

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**PAINTING - STRUCTURAL CERTIFICATION**

All Contractors or Subcontractors performing lead based paint removal, containment and collection, surface preparation, or coating of structural steel must be pre-qualified by MassDOT in the Painting - Structural category.

**MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION FILE  
NUMBER SIGN**

This project is subject to Massachusetts General Laws, Chapter 131, Section 40 as amended. Signs shall be in accordance with the latest MassDOT Construction Standards. All costs for the manufacture, erection, maintenance, moving, and removal of the signs shall be absorbed by the contractor with no additional compensation other than the contract unit prices.

For the portion of this project in Westford, Massachusetts, the Massachusetts Department of Environmental Protection File Number is XXX. For the portion of this project in Acton, Massachusetts, the Massachusetts Department of Environmental Protection File Number is XXX. For the portion of the project in Carlisle, Massachusetts, the Massachusetts Department of Environmental Protection File Number is XXX.

**SAWCUTS**

Sawcuts shall be made in the existing pavement at areas of new or reset curb, limits of full depth pavement construction, for the installation of traffic signal equipment and conduit, drainage pipes and structures and as directed by the Engineer. Payment for this work shall be included in the unit price under the applicable items.

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**GENERAL REQUIREMENTS FOR DEMOLITION AND WORK INVOLVING  
PAINTED STEEL**

(9/20/2012)

Demolition and work involving painted steel shall conform to the requirements of Section 961 of the Supplemental Specifications dated June 15, 2012.

**Work Involving Painted Steel.**

Hazardous materials shall be removed in the immediate area of any intended welding, heating, saw cutting or burning of steel. Hazardous material removal is required to allow the demolition of structural steel, railings, drainage systems, utility supports, steel lamp posts, etc.

The contractor shall assume that the coatings on the steel contain lead (Pb), unless otherwise determined by testing. The contractor shall certify in writing to the Engineer the results of all testing, and shall also certify that any lead (Pb) coated steel removed from the project was not reused or buried, but was sent to a scrap metal recycling facility.

Implement and maintain programs and procedures, which comply with the requirements of this specification and all applicable standards and regulations. Comply with all applicable regulations even if the regulation is not specifically referenced herein. If a state or local regulation is more restrictive than the regulation of this specification, follow the more restrictive requirements.

This requirement is intended only for the demolition and preparation prior to repair and does not include provisions for recoating of steel.

**Environmental**

All applicable portions of Sections 961.65 “Worker Protection” and 961.66 “Environmental Protection and Monitoring” shall be followed when performing this work.

During chemical stripping a hand washing facility may be used in lieu of a decontamination/changing facility.

Hazardous material shall be collected during the disassembly and disposed of as outlined in Section 961.68 “Handling of Hazardous Waste and Reporting Release Programs”.

The applicable submittals shall be according to Section 961.69 “Submittals”.

**Cleaning/Removal****Cutting Or Burning Of Steel**

All surfaces to be welded, heated, saw cut or burned shall be cleaned so as to remove all contaminants and/or hazardous materials, which could be discharged to the environment as a function of the subsequent operations.

Lead paint shall be removed in its entirety in an area prescribed by a 6 inch (15 cm) minimum offset from the required work. The paint removal operation may be dry abrasive blasting, wet abrasive blasting or chemical stripping.

Proper level of containment shall be used when performing this work in accordance with Section 961.67 "Containment". Full containment is not required during chemical stripping operation however; the Contractor shall install proper shielding and/or tarpaulins under the chemical stripping operations in order to catch all debris generated during this procedure. A cleaned area must be inspected and approved before the demolition operations are started.

During cleaning operations the Contractor shall be required to furnish and erect temporary floodlights illuminating the steel surface at a minimum of 30-foot candles. This lighting shall be used in areas where there is insufficient lighting for proper cleaning operations and inspection. The Contractor shall supply electrical power.

The Contractor shall provide support for interim and final inspection of the bridge during cleaning operations. This support shall include the necessary traffic controls and safe access to the work.

### **Mechanical Disassembly Of Steel**

All surfaces to be mechanically disassembled by shear cutting or removing bolts or rivets shall not require deleading. When shear cutting or removing bolts or rivets, the Contractor shall not use any method that will cause dust and/or particles to be emitted and/or dispersed into the environment to an extent that would expose the workers above the Action Levels of  $30\mu\text{g}/\text{m}^3$ .

For purposes of limiting the lead (Pb) dust, the Contractor will be required to dampen the lead paint work areas.

The contractor shall install a proper shielding and/or tarpaulins under all lead-paint-coated surfaces to be shear cut or bolts or rivets ordered removed in order to catch any loose lead paint chips, dust or particles.

### **PIGEON WASTE**

The Contractor shall remove and disposal of the pigeon waste and any other debris accumulated on the steel members and bridge seats in areas where work is being performed. Pigeon waste and debris material contaminates will require special handling and disposal in accordance with all Federal, state, and local requirements.

**NEW INTRODUCTIONS OF INVASIVE PLANTS INTO OR AROUND THE SITE**

(Supplementing Subsections 7.01(D) Plant Pest Control and 7.13 Protection and Restoration of Property)

The Contractor shall ensure that no invasive plant species, as defined and listed by the Massachusetts Invasive Plant Advisory Group, are introduced or moved around the site by construction activities either by improperly cleaned construction equipment or importation of infected materials such as borrow, compost, nursery stock, seed, or hay bales. Corrective measures, if necessary, shall be made by the Contractor as directed by the Engineer. The Contractor shall be solely responsible for all costs associated with ensuring that invasive species are not introduced or moved around the site by construction activities and for all corrective measures required for as long as necessary to eliminate the introduced invasive plant species and prevent re-establishment of same.

**PRESERVATION OF ROADSIDE GROWTH** (Supplementing Subsection 8.08)

The Contractor shall take all necessary care when excavating or working in the vicinity of existing trees so that the root systems, trunks, and branches are not damaged. All precautions shall be taken to insure that heavy equipment does not damage any roots, including those that lie below the limits of excavation.

Do not store equipment or stockpile materials within drip line of trees or in areas enclosed by tree protection fencing.

Avoid any direct soil contamination in root zone area by petroleum, petroleum products or solvents, salts or any other pollutant during construction.

All cutting or trimming of trees to be preserved shall be executed by a Massachusetts Certified Arborist. The Contractor shall provide the Engineer with a copy of the certification prior to any work on trees.

Existing plants adjacent to construction may be protected as a group using temporary fencing as specified under Item 102.52, or in the event of construction close to individual trees, using Individual Tree Protection as specified under Item 102.51.

Trees that, in the judgment of the Engineer, have been irreparably damaged by the Contractor shall be replaced in kind and in size, or, with a quantity of 2 inch caliper replacement trees (the quantity of which shall be determined by the Engineer) such that the cumulative caliper of the replacement trees will be up to the equivalent of diameter of the lost tree at breast height. Cost of replacement trees shall be paid by the Contractor.

Cost of removal of destroyed tree, including roots and stump, as well as the cost of replacement trees, shall be paid for by the Contractor.

**DIVISION II – TECHNICAL SPECIFICATIONS****ITEM 100.01   SCHEDULE OF OPERATIONS – FIXED PRICE \$100,000   LUMP SUM****8.02   Schedule of Operations - Type 2 (\$10,000,001 - \$50,000,000)****A.   General Requirements**

For Definition of Terms, see Subsection 8.02.B.

This Contract requires that a schedule control program be instituted by the Contractor to create a construction schedule that tracks and documents the progress of the Work from Notice to Proceed (NTP) through Final Acceptance.

This program requires the following schedule submittals to be made by the Contractor:

- Preliminary Schedule (first 120 Calendar Days after NTP)
- Contract Progress Schedules
- Short-Term Construction Schedules
- Summary Contract Progress Schedules
- Time Entitlement Analyses
- Recovery Schedules

The Contractor shall use computer software capable of preparing, statusing and revising Critical Path Method (CPM) schedules using precedence diagramming methods as approved by the Engineer.

The software shall be capable of printing activity reports and plotting CPM time-scaled logic diagrams, both of which shall be sortable by structures, facilities, subcontractors, submittals, deliveries, extra work orders and any other critical features of the Contract.

Within seven (7) Calendar Days after NTP, the Contractor shall submit to the Engineer sufficient information demonstrating that the CPM software it proposes to use on the Contract is fully capable of producing the specified schedules and tracking tools. The Engineer shall notify the Contractor in writing within seven (7) Calendar Days after receipt of the Contractor's notification on software (within fourteen (14) Calendar Days after NTP) if there are any objections to the CPM software selected.

The Basis of Payment for this work is shown in Subsection 8.02.F.

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**B. Definition of Terms**

**Activity** - An element in the Contract Progress Schedule describing a discrete part of the Work and establishing the time required for completing that part of the Work.

**Baseline Contract Progress Schedule** - The initial version of the Contract Progress Schedule, accepted by the Department, with or without comments, and showing the Contractor's plan for completion of the Work within the Contract Time in effect at the start of the Contract.

**Calendar Day** - Any day of the year, regardless of whether or not work is performed by the Contractor, which day of the week on which it falls, or whether or not it is a holiday.

**Critical Path** - Any continuous sequence of activities in the Contract Progress Schedule that controls achievement of a Contract Milestone and/or the Contract Completion Date.

**Construction Schedule** - The Schedule which shows the Contractor's approach to planning, scheduling, and execution of the Work, referred to herein as the Contract Progress Schedule.

**Contract Milestone** - A Contract Milestone is a significant and key instant of time with a zero (0) duration that highlights progress made on the project. Contract Milestones are specified in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents.

**Contract Progress Meeting** - A weekly or every other week schedule meeting to review the progress on the Short-Term Construction Schedule, including, but not limited to, the actual completion percentage, a comparison of actual dates with early dates, and any additional information deemed pertinent for a full and complete discussion of the Short-Term Construction Schedule. See also Subsection 8.02.E.6.

**Contract Progress Schedule** - The Contract Progress Schedule shows how the Work is to be completed from Notice to Proceed through Final Acceptance. Contract Progress Schedules may be Baseline, Revised, or Stated versions. See also Subsections 8.02.E.3 through 8.02.E.5.

**Contract Progress Schedule of Record** - The Contract Progress Schedule of Record is the latest Contract Progress Schedule accepted by the Engineer and is the official schedule of the project.

**CQE** - Contract Quantity Estimate or pay estimate that occurs every two (2) weeks. Also known as the progress payment.

**CPM** - Critical Path Method is a computerized construction project planning and scheduling process where a construction project schedule's critical path is the longest chain or path of activities leading to project completion.

**Delays** - Any slippage of the Early Dates in the Contract Progress Schedule which forecast a slippage in the Contract Milestone and/or the Contract Completion Date.

**Early Completion Schedule** - A CPM schedule showing completion of the Work ahead of the Contract Completion Date specified in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents.



Early and Late Dates - Early start or completion times and late start or completion times for the performance of activities in the Contract Progress Schedule.

Extra Work Order. A Contract Modification adding money and associated necessary time to the Contract. See also Subsection 8.10.B.1.

Final Acceptance - Full and complete satisfaction of the Contract Requirements, consisting of completion and acceptance of all physical work and submission and acceptance of all contractually-required reports and other documentation. See also Subsection 5.11.

Float - Float shall be defined as the amount of time between when an activity can start or finish (Early Start or Early Finish Date) and when an activity must start or finish (Late Start or Finish Date.) Float is further defined as the amount of time any given activity or path of activities may be delayed before it will affect the Contract Time. Float belongs to the project and is a shared commodity between the Department and the Contractor and is not for the exclusive use or benefit of either party. Either party has full use of the float until it is depleted. The float may be claimed by whichever party first demonstrates a need for it, i.e., that any activities on the critical path, where float equals zero, any Contract Milestones and/or the Contract Completion Date have been delayed. The Contractor shall demonstrate this need in a Time Entitlement Analysis meeting the requirements of Subsection 8.02.E.8.

Fragnet - a mini-schedule or sub-network containing a logically-linked group of activities or durations that illustrate a distinct event or period of time in the Contract Progress Schedule. Fragnets are typically used as the schedule portion of a Time Entitlement Analysis (TEA) and are required to be submitted as part of a TEA. See also Subsection 8.02.E.8.

Logic Diagram - A logic diagram is a type of construction project schedule that shows the progression of the work as a network where activities are linked by arrows with the tail of the arrow connected to the predecessor activity and the head of the arrow connected to the successor activity. Logic diagrams may be either time-scaled or non-time-scaled.

NTP - Notice to Proceed. A letter sent to a contractor after Contract Award by the Director of Contracts and Records containing the contractual start and completion dates. The date of this letter is referred to as the NTP Date.

Pay Estimate - See CQE.

Preliminary Schedule - The Preliminary Schedule is a summary-level Contract Progress Schedule that shows how the Contractor plans to perform the Work for the first one hundred and twenty (120) Calendar Days of the Contract on a detailed basis and how it plans to perform the remaining portion of the Work from Notice to Proceed to Final Acceptance on a less-detailed basis. See also Subsection 8.02.D.

Recovery Schedule - A Recovery Schedule is a detailed Revised Contract Progress Schedule that changes the Contract Progress Schedule of Record to show how the Contractor plans to recover from or make up the contract time lost on the project's critical path due to a delay. See also Subsection 8.02.E.9.

**Revised Contract Progress Schedule** - A Revised Contract Progress Schedule incorporates activities, logic ties, and relationships added to or deleted from the Contract Progress Schedule of Record based on a Time Entitlement Analysis accepted by the Engineer. See also Subsections 8.02.E.4 and 8.02.E.8.

**Short-Term Construction Schedule** - A Short-Term Construction Schedule details the daily work activities for a thirty-five (35) Calendar Day period, the two (2) weeks prior to the Contract Progress Meeting and the three (3) weeks following the meeting in a bar chart format. The daily activities shall correspond to the Contract Progress Schedule activities, but shall be at a greater level of detail. See also Subsection 8.02.E.6.

**Statused Contract Progress Schedule** - A Statused Contract Progress Schedule is a monthly update of the Contract Progress Schedule of Record. See also Subsection 8.02.E.5.

**Substantial Completion** - Substantial Completion occurs when either the Work has been completed except for work having a Contract Price of less than one (1) percent of the adjusted Total Contract Price or substantially all of the Work has been completed and opened to public use, except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the Work. See also Subsection 7.15 - Claims Against Contractors for Payment of Labor, Materials and Other Purposes.

**Summary Contract Progress Schedule** - A Summary Contract Progress Schedule is a separate and distinct schedule based upon the internal coding of the Contract Progress Schedule. This coding shall allow a summary-level Contract Progress Schedule to be produced that identifies major physical classes, structures, facilities, and/or other elements of the Work as discussed in Subsection 8.02.E.1. See also Subsection 8.02.E.7.

**Time Entitlement Analysis (TEA)** - A method of schedule delay analysis that shows the impacts of a particular delay by arranging the affected activities in a timeline of when the delay occurred. This allows the effect of a particular event or delay to be determined and illustrated. Fragnets are typically used as the schedule portion of a Time Entitlement Analysis (TEA) and are required to be submitted as part of a TEA. See also Subsection 8.02.E.8.

**Work Day** - Any day of the week on which work is performed by the Contractor, including Saturdays and Sundays, but excluding holidays observed by the Contractor.

## **C. Schedule Reviews**

The Engineer will respond to each schedule submittal within fifteen (15) Calendar Days of receipt providing comments and disposition that either accepts the schedule or requires revision and resubmittal.

Schedules shall be resubmitted within fifteen (15) Calendar Days after receipt of the Engineer's comments.

The Engineer's comments will address whether items of the Work have been omitted, if activity durations are reasonable or that the means, methods, timing and/or sequencing of the Work are practicable. The planning, scheduling, and execution of the Work and the accuracy of their

representation in the Contract Progress Schedule shall remain the sole responsibility of the Contractor.

The Contractor shall not be relieved from its responsibility for satisfactorily completing the Work within the specified Contract Time due to its failure to submit an acceptable Contract Progress Schedule.

Failure to submit schedules as and when required could result in the withholding of full or partial pay estimate payments by the Engineer.

#### **D. Preliminary Schedule**

The Preliminary Schedule shall be submitted to the Engineer within twenty-one (21) Calendar Days after Notice to Proceed.

The Preliminary Schedule shall be a summary-level Contract Progress Schedule that shows the Work being completed in accordance with the Contract Milestones contained in Subsection 8.03 – Prosecution of Work or elsewhere in the Contract Documents. It shall incorporate the Contractor's detailed work activities for the first one hundred and twenty (120) Calendar Days of the Contract. The portion of the Preliminary Schedule addressing the remainder of the Work shall be in sufficient detail and content, including logic ties and durations, to show the Contractor's general plan for completion of the Work in accordance with the Contract Milestones.

At a minimum, the Preliminary Schedule, as well as all subsequent schedules described in Subsection 8.02.E, shall clearly define the progression of the Work from Notice to Proceed to Final Acceptance by using separate activities for each of the following items:

- 1) Notice to Proceed
- 2) Each component of the Work
- 3) Procurement of permit modifications by the Contractor or the Engineer
- 4) The preparation and submission of shop drawings and other required submittals, the duration of which shall be determined by the Contractor
- 5) The review and return of shop drawings and other required submittals, the duration of which shall be a minimum of thirty (30) Calendar Days, unless otherwise approved by the Engineer
- 6) Items to be paid, such as, engineering work, permanent materials and equipment (material on hand), such as unfabricated structural steel (raw materials), equipment procurement, and equipment delivery to the site or storage location
- 7) Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third party work affecting this Contract

- 8) Interim Milestones listed in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents
- 9) The critical path, clearly defined and labeled
- 10) Float shall be clearly identified as defined in Subsection 8.02.B
- 11) Substantial Completion per the requirements of Subsection 7.15 - Claims Against Contractors for Payment of Labor, Materials and Other Purposes
- 12) Punchlist Completion Period
- 13) Physical Completion per the requirements of Subsection 5.11 - Final Acceptance
- 14) Documentation Completion per the requirements of Subsection 5.11 - Final Acceptance
- 15) Final Acceptance per the requirements of Subsection 5.11 - Final Acceptance

The work activities identified for the first one hundred and twenty (120) Days shall be in sufficient detail to support the pay estimate for that period, including all activities which the Contractor is required to perform or plans to perform and for which the Contractor intends to receive payment as specified in Subsection 9.01 – Measurement of Quantities.

The Preliminary Schedule shall be prepared and submitted in accordance with Subsections 8.02.E.1 and 8.02.E.2.

The Preliminary Schedule shall be valid for one hundred and twenty (120) Calendar Days after Notice to Proceed. The Preliminary Schedule will be superseded and replaced by the Baseline Contract Progress Schedule following its acceptance by the Engineer. If the Baseline Contract Progress Schedule not be accepted by the Engineer within one hundred and twenty (120) Calendar Days after Notice to Proceed, the Contractor shall revise the Preliminary Schedule to include the additional work activities that have occurred during the time period that has elapsed after the previous time period of one hundred and twenty (120) Calendar Days after Notice to Proceed, status the schedule as required by Subsection 8.02.E.5 and resubmit it no less than every two (2) weeks until the Baseline Contract Progress Schedule is accepted by the Engineer. This revised, statused Preliminary Schedule shall be called the Statused Preliminary Schedule. For Baseline Contract Progress Schedule requirements, see Subsection 8.02.E.3.

No pay estimate shall be approved by the Engineer until the Preliminary Schedule has been submitted to the Engineer, unless otherwise agreed to by the Engineer.

## **E. Contract Progress Schedules**

### **1. Requirements for all Contract Progress Schedules**

All Contract Progress Schedules listed in Subsection 8.02.A and described in Subsections 8.02.E.3 through 8.02.E.9 shall fully conform to the following requirements:

- a. **LOGIC:** The Contract Progress Schedule shall divide the Work into activities with appropriate logic ties, to show; (i) the Contractor's overall approach to the planning, scheduling and execution of the Work, (ii) consistency with the requirements of this Subsection, (iii) the Contractor's approach to conformance with any sequences of Work required by the Contract Documents, including, but not limited to, Subsection 8.03 - Prosecution of Work and Subsection 8.06 – Limitations of Operations.
- b. **ACTIVITIES:** The Contract Progress Schedule shall clearly and separately define the progression of Work from Notice to Proceed to Final Acceptance by using separate activities as described in Subsection 8.02.D.
- c. **EARLY AND LATE DATES:** Early Dates consist of Early Start and Early Finish dates. The Early Start date is the earliest date an activity can start or commence. The Early Finish date is the earliest date an activity can finish or be completed. Late Dates consist of Late Start and Late Finish dates. The Late Start date is the latest date an activity can start without delaying or lengthening the duration of the project. The Late Finish date is the latest date an activity can finish or be completed without delaying or lengthening the duration of the project.
- d. **DURATIONS:** Activity durations shall be in Work Days. Durations shall be regulated by a work breakdown structure (WBS) of physical elements of the Work determined by work discipline, station number, or structure, which reflect the time the Contractor and/or Subcontractors require to perform the related work.
- e. **ITEMS TO BE PAID:** The Contractor shall specifically identify in the Contract Progress Schedule all items of permanent materials and equipment (Materials On Hand) for which the Contractor intends to request payment, in accordance with Subsection 9.04 - Partial Payments, prior to the incorporation of such items into the Work.
- f. **ACTIVITY DESCRIPTIONS:** The Contractor shall use standard activity descriptions in all Contract Progress Schedules that clearly describe the work to be performed using a combination of words, structure numbers, station numbers, bid item numbers, work breakdown structure (WBS) and/or elevations in a concise and compact label.
- g. **ACTIVITY IDENTIFICATION NUMBERS:** The Contractor shall use the standard activity identification numbering system specified below for all activities in all Contract Progress Schedules:

```

C# # # # # - # # #
  |       |
  |       |
  |       + - - - - Sequential Numbering Code
  |
  |
+ - - - - Contract Number

```

- **Contract Number** - The first seven (7) characters of the activity identification number shall consist of a “C” for Contract followed by the five (5) digit Department contract number and ended with a dash.

- Sequential Numbering Code - The second set of characters in the activity identification number, the actual number of characters to be determined by the Contractor, shall consist of a sequential numbering system created by the Contractor denoting work breakdown structure (WBS), locations, station numbers, major areas of construction, structure types, structure designations, class of work, type of activity, bid item number, milestone number, phase of the Work and/or any other type of information that the Contractor wishes to include in its activity identification numbering code.

h. **ACTIVITY CODES:** The Contractor shall use all of the following sortable standard activity codes in all Contract Progress Schedules:

Code	Code Designation
DIST	MassDOT Highway Division District Number
TOWN	City / Town Name
MSNO	Contract Milestone Number Designation
BIDI	Bid Item Number Designation
STRUC	Type of Structure Designation
RESP	Organization Responsibility Code
OTHR	Other Field
PHAS	Phase of the Work or of the Construction Schedule

**DIST – MassDOT Highway Division District Number:** A one-digit code corresponding to the MassDOT Highway Division District in which the project is located:

1	MassDOT Highway Division District 1
2	MassDOT Highway Division District 2
3	MassDOT Highway Division District 3
4	MassDOT Highway Division District 4
5	MassDOT Highway Division District 5
6	MassDOT Highway Division District 6
S	MassDOT Highway Division Statewide

**TOWN – City / Town Name:** A four (4) letter code using the first four letters of the name of the city or town in which the project is located.

Example:

MANS                      Mansfield

**MSNO – Contract Milestone Number Designation:** A two (2) digit code corresponding to the Contract Milestone number contained in Subsection 8.03 - Prosecution of Work that is at the end of the activity's sequence chain.

Example:

03                      Milestone No. 3 – Substantial Completion

**BIDI – Bid Item Number Designation:** A seven (7) digit code corresponding exactly, including periods and spaces, to the bid item number with which the activity is associated.

Example:

975.3

Metal Bridge Railing

PCM

Activity added by Proposal or Contract Modification

**PROJ – Primary Project Type:** A one (1) or two (2) letter code corresponding to the primary project type or type of structure as shown below. Additional codes may be added by the Contractor as approved by the Engineer.

BC	Bridge Modification or Rehabilitation
BN	Bridge New
BR	Bridge Replacement
BP	Bike Path
CB	Catch Basin
D	Demolition
H	Highway Reconstruction (local road or state highway)
HI	Highway Reconstruction (interstate highway)
P	Painting
R	Resurfacing
S	Surfacing
TS	Traffic Signals
TU	Tunnels
U	Utilities
V	Vertical Construction (Chapter 149)

**RESP – Organization Responsibility Code:** A one (1) to five (5) digit code corresponding to the initials of the organization responsible for performing the work contained in the activity. Examples of this coding are:

MIW	McGrath Iron Works
BCEC	Bay City Electric Company
MBTA	Massachusetts Bay Transportation Authority
CSX	CSX Railroad Corporation
MDOT	Massachusetts Department of Transportation Highway Division

**OTHR – Other Field:** A seven (7) digit code reserved for the exclusive use of the Engineer as required for coding miscellaneous items such as contract modifications, submittal activities, time and material work, force account work, or other category of work activity that may prove to need such coding during the progress of the Work.

XXX

A description of something other than the above.

- i. **CALENDARS:** Different calendars may be created and assigned globally, i.e., applying to all activities, or individually to each activity. Calendars define the available hours of

work in each Calendar Day, Holidays and general or project-specific non-Work Days. Examples of non-Work Days include, but are not limited to:

- Winter Shutdown Period: December 1 thru March 15. This may be optional depending on any requirements that may be stated elsewhere in this Contract.
- Peak traffic hours on heavily traveled roadways
- Special requirements by sensitive abutters, railroads, utilities and/or other state agencies.
- Cape Cod Summer Roadway Work Restrictions: While these restrictions may be project-specific based on such factors as the exact location of the project, whether or not the roadway involved has a high traffic volume and/or is a main route, its proximity to beaches and other popular tourist attractions, and its overall impacts on traffic and tourism, they are generally enforced between Memorial Day and Labor Day, unless otherwise directed by the Engineer.
- Cape Ann Summer Roadway Work Restrictions: While there are no general restrictions for Cape Ann as there are for Cape Cod, project-specific restrictions may be enforced based on the same factors listed above for Cape Cod.
- Turtle and Fish Migration Periods and/or other in-water work restrictions: Project-specific
- Working over Waterways Restricted Periods: Project-specific
- Night-time paving and striping operations temperature restrictions: Project-specific

j. NOT TO BE USED: Unspecified milestones or constrained dates, scheduled work not required for the accomplishment of a Contract Milestone, use of activity durations, logic ties and/or sequences deemed unreasonable by the Engineer, delayed starts of follow-on trades, or use of float suppression techniques contrary to the provisions of Subsection 8.05 – Claim for Delay or Suspension of the Work shall not be used in the Contractor's Progress Schedule.

k. FLOAT: See Subsection 8.02.B.

**l. THIS SECTION NOT USED.**

## **2. Contract Progress Schedule Reporting and Submittal Requirements**

All Contract Progress Schedules listed in Subsection 8.02.A and described in Subsections 8.02.E.3 through 8.02.E.9 shall be prepared and submitted in accordance with the requirements listed below.

Each Contract Progress Schedule submittal shall be uniquely identified.

Contract Progress Schedules shall be prepared using the computerized construction scheduling software described in Subsection 8.02.A and approved by the Engineer.

All Contract Progress Schedule submittals shall include each of the following documents, prepared in two formats; copied to three (3) compact discs (CD) and three (3) copies plotted on paper, for distribution as follows: one (1) copy each for the Boston Construction, District Construction and Resident Engineer's Offices:



**a. Narratives**

A Narrative is a written description of the schedule that shall:

- (i) itemize and describe the flow of work for all activities on the Critical Path;
- (ii) compare Early and Late Dates for activities on the Critical Path;
- (iii) show progress highlights and quantify Work Days gained or lost versus the Contract Progress Schedule of Record;
- (iv) describe the Contractor's plan, approach, methodologies, and resources to be employed for completing the various operations and elements of the Work;
- (vi) itemize shifts, Holidays, and if multiple calendars are applied to the activities, uniquely identify each calendar.

**b. Bar Charts**

Time scaled bar charts shall be prepared using a scale that yields readable plots and that meet the requirements of Subsection 8.02.E.1. Activities shall be linked by logic ties and shown on the Early Dates. Critical paths shall be highlighted and Total Float shall be shown for all activities. The paper plots of schedule Bar Charts shall be as follows:

24" X 36"-sized paper shall be used for Baseline Schedules, Revised Contract Progress Schedules and Recovery Schedules;

11" X 17" - sized paper shall be used for all other schedule types and Time Entitlement Analyses. These may be submitted as a .pdf file, if approved by the Engineer.

**c. Time scaled Logic Diagrams**

Time scaled logic diagrams shall be prepared using a scale that yields readable plots and that meet the requirements of Subsection 8.02.E.1. Activities shall be linked by logic ties and be shown on the Early Dates. Critical paths shall be highlighted and Total Float shall be shown for all activities. Paper plots of time-scaled logic diagrams shall be submitted as stated in Subsection 8.02.E.2.b - Bar Charts

**d. Detailed Activity Schedule Comparisons**

A Detailed Activity Schedule Comparison is a simple reporting tool in the format of a graphical report that will provide Resident Engineers with immediate, timely and up-to-date information. The Detailed Activity Schedule Comparison consists of an updated bar chart that overlays the previous time period's bar chart for an easily-read comparison of progress during the present and previous reporting periods. Simple instructions for creating Detailed Activity Schedule Comparisons appear on the MassDOT Highway Division website at: <http://www.massdot.state.ma.us/Highway/>

**e.** THIS SECTION NOT USED.

**f.** THIS SECTION NOT USED.

**g.** THIS SECTION NOT USED.

### **3. Baseline Contract Progress Schedule**

The Baseline Contract Progress Schedule shall be due seventy-five (75) calendar days after Notice to Proceed. The Baseline Contract Progress Schedule shall only reflect the Work awarded to the Contractor and shall not include any additional work involving extra work orders or any other type of alleged delay.

The Baseline Contract Progress Schedule shall include all activities and content contained in the Preliminary Progress Schedule for the first one hundred and twenty (120) Calendar Days after NTP. Variations from the durations, logic, and work plan identified in the Preliminary Progress Schedule shall be limited to correction of errors in logic and/or addition of detail. All changes shall be clearly highlighted and identified and explained and justified in writing as part of the Contract Progress Schedule Narrative required in Subsection 8.02.E.2.a.

The Baseline Contract Progress Schedule shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2.

Once the Baseline Contract Progress Schedule has been accepted by the Engineer, with or without comments, it will represent the as-planned schedule for the Work. It shall then be known as the Baseline Schedule and shall be the Contract Progress Schedule of Record until such time as the schedule is updated or revised under Subsections 8.02.E.4 and .5.

Failure to submit a Baseline Contract Progress Schedule within seventy-five (75) Calendar Days after Notice to Proceed could result in withholding of full or partial payments by the Engineer. Beyond one-hundred and fifteen (115) Calendar Days after Notice to Proceed, no pay estimate will be approved by the Engineer until the Baseline Contract Progress Schedule has been submitted, unless otherwise agreed to by the Engineer.

### **4. Revised Contract Progress Schedules**

Upon review and acceptance by the Engineer of revised activities and/or logic ties contained in Time Entitlement Analyses prepared in accordance with Subsection 8.02.E.8 or Recovery Schedules prepared in accordance with Subsection 8.02.E.9, these changes shall be incorporated into the next Stated Contract Progress Schedule as a Revised Contract Progress Schedule. A Revised Contract Progress Schedule shall be due with the pay estimate immediately following the Engineer's acceptance of the schedule changes.

Revised Contract Progress Schedules shall include a comprehensive listing of all activities added to or deleted from the Contract Progress Schedule of Record as well as a complete listing of all logic and activity relationship changes which have been made. All changes shall be clearly highlighted and identified and explained and justified in writing as part of the Contract Progress Schedule Narrative required in Subsection 8.02.E.2.a.

Revised Contract Progress Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2.

Once a Revised Contract Progress Schedule has been returned by the Engineer to the Contractor as "Resubmittal Not Required", it shall become the Revised Contract Progress Schedule of Record, meaning it shall be used for subsequent Stated Contract Progress Schedules.

Except as otherwise designated by a Contract Modification, no Revised Contract Progress Schedule that extends performance beyond the Contract Time and/or any Contract Milestone shall qualify as a Revised Contract Progress Schedule of Record.

## **5. Stated Contract Progress Schedules**

Stated (Updated) Contract Progress Schedules shall be submitted by the Contractor along with the first pay estimate of each month.

A Stated Contract Progress Schedule shall consist of the following:

1. A Schedule Narrative consistent with Subsection 8.02.E.2.a.
2. A Summary Contract Progress Schedule consistent with Subsection 8.02.E.7.

Each Stated Contract Progress Schedule shall reflect updated progress to the status date and shall forecast the finish dates for in progress activities and remaining activities, but shall not change any activity descriptions, durations, or sequences without the acceptance of the Engineer. Updated progress shall be limited to as built sequencing and as built dates for completed and in progress activities. As built data shall include actual start dates, remaining Work Days, and actual finish dates for each activity.

Stated Contract Progress Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2 along with the first pay estimate of the month, but no later than fourteen (14) Calendar Days after the pay estimate submittal.

Accepted Stated Contract Progress Schedules shall update and replace the Contract Progress Schedule of Record.

Stated Contract Progress Schedules submitted later than fourteen (14) Calendar Days after the pay estimate submittal will be deemed to be no longer useful and will not qualify for payment. However, failure to submit a Stated Contract Progress Schedule within any monthly period, whether on time or late, could result in the withholding by the Engineer of the remainder of the pay estimate payment due for that time period.

## **6. Short Term Construction Schedule**

The Contractor shall provide a Short Term Construction Schedule that details the daily work activities, including multiple shift work that the Contractor intends to conduct, in a bar chart format. The daily activities shall correspond to the Contract Progress Schedule activities, but shall be at a greater level of detail.

The Short- Term Construction Schedule shall be submitted at each Weekly or Bi-Weekly (every two (2) weeks) Contract Progress Meeting, but, regardless of the frequency of progress meetings, shall be submitted no less often than once every two (2) weeks. It shall display all work for a

thirty-five (35) Calendar Day period: completed work for the two (2) week period prior and all planned work for the three (3) week period following the Contract Progress Meeting or the end of the previous two (2) week period.

The Contractor shall be prepared to discuss the Short Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, schedule of work affecting abutters, and corresponding work with affected utilities.

Short Term Construction Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and 8.02.E.2.

Failure to submit Short Term Construction Schedules at each Contract Progress Meeting could result in withholding of full or partial pay estimate payments by the Engineer.

## **7. Summary Contract Progress Schedule**

The Summary Contract Progress Schedule is not a separate, stand-alone schedule that must be formally submitted by the Contractor, unless requested by the Engineer, but is a schedule that is created using the internal coding of the detailed Contract Progress Schedule. The Contract Progress Schedule shall be coded such that a summary-level Contract schedule may be produced that identifies major physical classes, structures, facilities or other elements of the Work as discussed in Subsection 8.02.E.1. The durations of summary activities shall coincide with the Contract Time and Contract Milestones shown in Subsection 8.03 - Prosecution of Work. The activity descriptions for all summary-level activities shall be subject to the review and acceptance of the Engineer.

## **8. Time Entitlement Analysis**

A Time Entitlement Analysis (TEA) consists of a descriptive narrative, prepared in accordance with Subsection 8.02.E.2.a, and an as-built CPM schedule, in the form of a fragnet, see Subsection 8.02.B - Definition of Terms, that has been developed from the project's Contract Progress Schedule of Record, see Subsections 8.02.E.3-5, and illustrates the impact that additional time, added to the Contract Progress Schedule of Record by a delay or an extra work order, has on the Contract Progress Schedule of Record's critical path, Contract Milestones, and/or Contract Completion Date. TEAs shall be used to determine the schedule impact of extra work orders. A TEA may also be referred to as a Proposal Schedule, a Time Impact Analysis or a Time Impact Evaluation.

TEAs shall incorporate all proposed activities and logic ties required to implement the extra work order or other schedule impacts as well as detailing all impacts on existing activities, logic ties, the critical path, Contract Milestones, and the Contract Completion Date. In addition, TEAs shall accurately reflect any changes made to activities, logic ties, and restraints, necessitated by the extra work order, for the completion of the remaining work.

Any TEA prepared for the purpose of requesting a time extension shall clearly indicate any proposed overtime hours or additional shifts that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts and shall have the right to require that overtime hours and/or additional shifts be used to minimize

the duration of time extensions if it is determined to be in best interest of the Department to do so.

TEAs shall be prepared and submitted in accordance with the requirements of Subsections 8.02.E.1 and 2 and shall be based on the Contract Progress Schedule of Record for the time the delay starts.

TEAs shall be submitted as part of an extra work order submission, a request for a time extension or within fourteen (14) Calendar Days after a request for a TEA by the Engineer.

When accepted, the changes included in a TEA shall be incorporated into a Revised Contract Progress Schedule per the requirements of Subsection 8.02.E.4 and resubmitted to the Engineer.

Failure to submit a TEA within fourteen (14) Calendar Days of a request from the Engineer could result in withholding of full or partial pay estimate payments by the Engineer.

## **9. Recovery Schedules**

The Contractor shall promptly report to the Engineer all schedule delays during the prosecution of the Work.

In addition, a Recovery Schedule shall be required whenever the Critical Path of the Contract Progress Schedule of Record exceeds the greater of:

- a.) A delay of twenty (20) Calendar Days, or
- b.) A delay equal to 5% of the Calendar Days remaining until the Contract Completion Date due to any of the three situations listed below:
  1. If the contractor is behind schedule due to the fault of the contractor.
  2. If the contractor anticipates becoming behind schedule due to the fault of the contractor.
  3. When the delay is not the fault of the Contractor and the Department chooses to recover the lost time and requests a proposal to achieve that.

Recovery Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2 within fourteen (14) Calendar Days of any of the cases listed above.

Failure to submit a Recovery Schedule when and as required could result in withholding of full or partial pay estimate payments by the Engineer.

## **10. Disputes**

All schedules shall be submitted, reviewed, dispositioned, and accepted in the timely manner specified in Subsection 8.02.C so as to provide the greatest possible benefit to the execution of this Contract.

Any dispute concerning the acceptance of a schedule or any other question of fact arising under this subsection shall be determined by the Engineer.

Pending resolution of any dispute, the last schedule accepted by the Engineer will remain as the Contract Schedule of Record as described in Subsections 8.02.E.3-5.

#### **F. Basis of Payment**

1. All required schedule-related work, including, but not limited to, computer software, schedule preparation and schedule submittals will be paid under Pay Item 100.01 as defined below.
2. Failure to submit schedules within the time periods stated elsewhere in this subsection could result in the withholding of full or partial Contract pay estimate payments by the Engineer.
3. A fixed price of \$100,000 will be provided to the Contractor for the Project Schedule Submittal requirements contained herein. The Contractor is advised that this “fixed price” value is separated from what the Department considers to be the Contractor’s general condition costs for payment purposes only. If the Contractor deems it necessary to include additional costs to provide all of the requirements of this section, these additional costs shall be included in the Contractor’s general conditions. The fixed price payment item shall be earned as a fixed amount set by the Department at the time of the bid. Each bidder shall include this fixed price bid item value in the total bid value. Failure to do so will be grounds for the rejection of the bid.
4. Twenty percent (20%) of this pay item will be paid upon receipt by the Engineer of the Contractor’s Baseline Schedule, prepared and submitted in accordance with Subsection 8.02.E.3.
5. The remaining eighty percent (80%) of this pay item will be paid in equal monthly installments distributed across the time remaining until the time that the payment occurring immediately after Substantial Completion has been made. This calculation will be subject to revision should Substantial Completion be delayed beyond the original calculation date.

#### **PAY ITEM**

100.01            SCHEDULE OF OPERATIONS - FIXED PRICE \$100,000            LS

**ITEM 101.****CLEARING AND GRUBBING****ACRE**

The work under this Item shall conform to the relevant provisions of Section 101 of the Standard Specifications and the following:

The Contractor shall collect all organic material (leaves, pine needles, twigs, etc.) down to the mineral subsoil. All trash and/or non-organic material shall be removed from what was collected. The material shall be stockpiled on site for use as compost topsoil.

**COMPENSATION**

Compensation for this work will be made at the Contract unit price under Item 101.

**ITEM 102.51**  
**ITEM 102.52****INDIVIDUAL TREE PROTECTION**  
**TEMPORARY TREE PROTECTION FENCE****EACH**  
**FOOT**

The work under these items shall conform to the relevant provisions of Sections 101, 644 and 771 and the following:

The purpose of these items is to prevent damage to branches, stems and root systems of existing individual trees as well as shrubs and other quality vegetation to remain, and to ensure their survival. To the extent possible, to avoid soil compaction within the root zone, construction activities including, but not limited to, vehicle movement, excavation, embankment, staging and storage of materials or equipment shall not occur underneath the canopy (drip line) of trees to remain. Where these activities will occur within 10 feet of the canopy of trees or where directed, the Contractor shall take the appropriate protective measures specified herein.

Individual Tree Protection, Item 102.51, shall be used when construction activities are likely to occur within the canopy of individual trees or where there may be any risk of damage to trees.

Temporary Tree Protection Fence, Item 102.52, shall be used to protect areas of existing trees or other areas of quality vegetation that is to remain.

The Contractor shall be solely responsible for judging the full extent of the work requirements, including, but not necessarily limited to any equipment and materials necessary for providing tree protection.

Incidental to the cost of these items, the Contractor shall retain the services of a certified arborist, who shall make recommendations as to the specific appropriate treatment of trees within or near the work zone.

Prior to any construction activities, the Contractor and Arborist shall walk the site with the Engineer and Town Tree Warden to identify which trees will require protection and to determine approved measures. The Arborist shall make recommendations as to appropriate methods to protect the trees. The Engineer will have final decision as to trees and methods.

The Contractor is responsible for the protection of all existing trees and plants within and immediately adjacent to the construction area that are not designated to be removed for the length of the construction period.

### SUBMITTALS

Incidental to this item, the Contractor shall provide to the Engineer one (1) copy American National Standards Institute (ANSI) Standard Z-133.1 and A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance, Part 1: Pruning. These references shall be kept by the Engineer at his office for the length of the Contract.

Prior to start of work, the Contractor shall submit to the Engineer the name and certification number of the Massachusetts Certified Arborist referenced herein. Cost for Certified Arborist for all activities pertaining to this Item shall be incidental to this item.

### MATERIALS

Fence and temporary fence posts shall be subject to the approval of the Engineer.

Fencing for individual plants shall be polyethylene fencing or chain link fence (new or used).

Staking for individual tree protection fencing shall be steel posts or 2x4 lumber as directed and approved by the Engineer.

Wood chips shall conform to provisions of Wood Chip Mulch under Materials Section M6.04.3.

Trunk protection shall be 2x4 cladding, at least 8 feet in length, clad together with wire. Alternative materials shall be at the approval of the Engineer. Alternative materials shall provide adequate protection from anticipated construction activities and shall not injure or scar trunk. Trunk protection shall include burlap to separate trunk cladding from bark.

Temporary Tree Protection Fence shall be brightly colored polypropylene barricade or wooden snow fencing for tree protection or safety fencing as shown on the Contract drawings or as directed by the Engineer. Fencing shall be a minimum of 4 feet high and supported by steel or hardwood stakes spaced at a maximum of 8 feet on center or by other means acceptable to the Engineer. Fencing shall be materials and fastenings sufficient to provide sturdy and highly visible separation of the construction activities from the trees and existing plantings to be preserved.

Incidental to these items, the Contractor shall provide water for maintaining plants in the construction area that will have exposed root systems for any period during construction.

### CONSTRUCTION METHODS

To the extent possible, to avoid soil compaction within the root zone, construction activities including, but not limited to, vehicle movement, excavation, embankment, staging and storage of materials or equipment shall not occur underneath the canopy (drip line) of trees to remain. Where these activities will occur within 10 feet of the canopy of trees, the Contractor shall provide Individual Tree Protection as specified herein.



For individual tree protection, the Contractor shall set posts and fencing at the limits of the tree canopy. Where construction activities closer to the trees is unavoidable, the contractor shall tie branches out of the way and place wood chips to a depth of 6 inches on the ground to protect the root systems. The Contractor shall wrap the area of the trunk of the tree with burlap prior to armoring with 2x4 cladding. Cladding for tree trunks shall extend from the base of the tree to at least 8 feet from the base.

To the extent possible, temporary landscaped fencing shall be installed at the limit of tree canopy and shall be staked and maintained vertical for the length of the contract.

Where excavation within canopy is unavoidable, the Contractor shall use equipment and methods that shall minimize damage to the tree roots, per recommendations of the Certified Arborist. Such methods may require root pruning prior to, as well as during, any excavation activities.

All fencing, trunk protection, branch protection, and woodchips shall be maintained throughout the duration of the contract. Protective fencing shall be repaired and woodchip mulch replaced as necessary during the duration of the contract at no additional cost.

#### Cutting and Pruning

Some pruning of roots and branches may be a necessary part of construction. Pruning will be performed on the same side of the tree that roots have been severed.

The Contractor shall retain the services of a Massachusetts State Certified Arborist to oversee any cutting of limbs, stem or roots of existing trees. All cuts shall be clean and executed with an approved tool. Under no circumstances shall excavation in the tree protection area be made with mechanical equipment that might damage the existing root systems.

Any tree root area exposed by construction shall be covered and watered immediately. Exposed tree roots shall be protected by dampened burlap at all times until they can be covered with soil.

#### Watering

Water each tree within the construction area where work is in progress twice per week until the surrounding soil of each tree is saturated for the duration of construction activities.

#### Removal of Protection

After all other construction activities are complete, but prior to final seeding, wood chips, temporary fencing, branch protection, and trunk protection materials shall be removed and disposed off site by the Contractor at no additional cost.

#### Tree Damage

The Contractor shall be held responsible for the health and survival of the existing trees in the immediate vicinity of the of the construction area. Damage that, in the Engineer's opinion, can be remedied by corrective measures shall be repaired immediately. Broken limbs shall be pruned according to industry standards. Wounds shall not be painted. Trees or shrubs that are damaged irreparably shall, at the Engineer's discretion, be replaced per the requirements of Division I of these Special Provisions. Cost of replacement trees shall be borne by the Contractor.

## COMPENSATION

Where the plans show specific, individual trees to remain and where grading or other disturbance is shown within the drip line of these trees or where the Engineer determines that an individual tree must be protected, these trees shall be protected and paid for under Item 102.51 Individual Tree Protection per each tree protected.

Temporary landscape fence will be measured for payment by the foot of fence installed, complete in place.

Payment under these items shall be scheduled throughout the length of contract: 30 percent of value shall be paid upon installation, 30 percent approximately halfway through the contract, and the remainder to be paid at the end of the contract after completion of construction operations that would disturb plants and after the protection materials have been removed and properly disposed of off-site by the Contractor.

Compensation for Individual Tree Protection will be paid for at the contract unit price per each under Item 102.51. This item shall include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work, including the services of a certified arborist, water and fertilizer, and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract.

Where construction disturbance, such as grading activities, will occur within the limits of the canopy of groups of trees, these trees shall be protected and paid for under Item 102.52, Temporary Tree Protection Fence.

Temporary Tree Protection Fence will be paid for at the Contract unit price per foot. This item shall include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work, including the services of a certified arborist, water and fertilizer, and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract.

Cost of wood chips, as required, shall be incidental to these items.

## ITEM 127.12

## SUBSTRUCTURE DEMOLITION

## CUBIC YARD

The work to be performed under this item shall conform to the relevant provisions of Sections 112, 120 and 140 of the Standard Specifications and the following:

Work under this item shall include the removal of the stone masonry backwalls and wingwalls as required and as shown on the contract drawings. All materials removed shall become property of the contractor and shall be properly disposed of away from the work site.

The Contractor's operations shall not result in any damage to adjacent structures or foundations to remain. Any damage to adjacent structures that are to remain that are damaged as a result of the Contractor's operations, shall be repaired by the Contractor to the satisfaction of the Engineer and at no additional expense.

The Contractor shall take all the measures necessary to ensure that all demolition materials will be prevented from falling into the adjacent waterways below. All materials, equipment, labor, etc. to accomplish this task shall be considered incidental to this Item. Any material that falls into such areas shall be removed immediately, and at the Contractor's expense.

**Animal Waste/Debris Removal & Cleaning Abutment Seats and Steel Members**

The Contractor shall remove all accumulation of sediment, debris, and animal waste from the tops of abutment bridge seats (including drainage troughs), steel members, and other areas where work is being performed as directed by the Engineer. Animal waste and debris material contaminates will require special handling and disposal in accordance with all Federal, state and local requirements.

The Contractor shall clean all exposed surfaces of abutment seats by washing with high pressure water to the Satisfaction of the Engineer. All costs of cleaning abutment seats including debris collection & removal, disposal and high pressure washing shall be considered incidental to the Substructure Demolition pay item 127.12.

**COMPENSATION**

The contractor will make his own investigation of the structure to be demolished including the materials that are part of, or may be stored in the structure. No increase will be made to the bid price due to the nature of the materials involved in the demolition. All costs for permits, dump fees, special handling of hazardous materials, etcetera, shall be included in the bid price of the demolition item.

Substructure demolition will be measured for payment by the cubic yard, based upon the limits shown on the Plans and as defined by the Engineer, complete in place.

Substructure demolition will be paid for at the Contract unit price per cubic yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 129.5**

**TRACK EXCAVATION**

**FOOT**

The work under this item shall conform to the relevant provisions of Sections 112 of the Standard Specifications and the following:

**DESCRIPTION**

The work shall consist of the removal and disposal of the existing railroad track rails, plates and connection hardware as shown on the plans.

The removal and disposal of creosote wood ties shall be in accordance with and paid for under Item 184.1 Disposal of Treated Wood Products.

With the exception of railroad equipment to be removed and reset as shown on the plans, the removal and disposal of all other materials related to the railroad facilities shall be in accordance with and paid for under Item 120.1 Unclassified Excavation.

### Disposal of Materials

The steel track rails, plates and connection hardware shall become the property of the Contractor who shall properly dispose of all such materials at a facility licensed to process the material.

### Submittals

The Contractor shall submit for review and approval the methods and equipment proposed for removal and disposal of the steel track rails.

### COMPENSATION

Track excavation will be measured for payment by the foot along the centerline of the track bed and shall include both rails and all associated hardware.

Track excavation will be paid for at the at the Contract unit bid price per foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

### **ITEM 180.1**

### **HEALTH AND SAFETY PLAN**

### **LUMP SUM**

It is the Contractor's ultimate responsibility to ensure the health and safety of all the Contractor's employees and subcontracting personnel, the Engineer and his representatives, and the public from any on-site chemical contamination.

A Health & Safety Plan (HASP) shall be prepared by a Certified Industrial Hygienist or other experienced individual with the appropriate training required by OSHA to prepare such a plan, and it shall include the components required by OSHA 29 CFR 1910.120(b). The preparer's name and work experience shall be included as part of the Health and Safety Plan submittal. The HASP must be stamped by a Certified Industrial Hygienist certifying that it complies with all applicable laws, regulations, standards and guidelines, and that it provides a degree of protection and training appropriate for implementation on the project during the execution of this contract.

The HASP shall be designed to identify, evaluate, and control health and safety hazards associated with the work on this project and provide for emergency response if needed. The HASP shall be a dynamic document with provision for change to reflect new information, new practices or procedures, changing site environmental conditions or other situations which may affect site workers and the public. Health and safety procedures provided by the Contractor shall comply with all the appropriate regulations that address employee working conditions (e.g. OSHA, RCRA, CERCLA). In addition, guidelines of NIOSH, OSHA, USCG, EPA, etc., shall be followed. Equipment used for the purpose of health and safety shall be approved and meet pertinent standards and specifications of the appropriate regulatory agencies.

A copy of the Health and Safety Plan shall be maintained on-site at all times by the Contractor. The on-site copy shall contain the signature of the Engineer and each on-site employee of the Department, Contractor and subcontractors. The employee's signature on the Health and Safety Plan shall be deemed prima facie evidence that the employee has read and understands the plan. A copy of the plan with signatures shall be submitted to the Engineer at the conclusion of the Contract, or at the Engineer's request. Signature sheets shall be submitted monthly, or at the request of the Engineer.

## BASIS OF PAYMENT

The work to be done under this Item shall be paid at the Contract Lump Sum Price under Item 180.1 for the development and preparation of the HASP by a qualified individual.

### ITEM 180.2

### IMPLEMENTATION OF HEALTH AND SAFETY PLAN

### HOURLY

For all construction activities which require handling or exposure to potentially hazardous materials, the Health and Safety Plan shall specify an on-site Safety Officer. The Site Health and Safety Officer duties shall include, but are not limited to: implementation of the site Health and Safety Plan, training, evaluating risks, safety oversight, determining levels of personnel protection required, and performing any required monitoring at the site. A Daily Log shall be kept by the on-site Safety Officer and provided weekly to the Engineer. This log shall be used to record a description of the weather conditions, levels of personnel protection being employed, monitoring data and any other information relevant to on-site safety conditions. The Site Health and Safety officer shall sign and date the Daily Log.

In the event that subsurface contamination is discovered during construction, the Site Safety Officer shall be present to oversee all handling, storage, sampling, and transport of such contaminated materials.

The level of protection, relative to respiratory and dermal hazards, required to ensure the health and safety of on-site personnel will be stipulated in the Health and Safety Plan and will be subject to modification by the on-site Safety Officer based on changing site and weather conditions and the following factors: type of operation or activity, chemical compounds identified on-site, concentration of the chemicals, physical state of the hazardous materials, potential duration of exposure to hazardous materials, dexterity required to perform work, decontamination procedures, necessary personnel and equipment, and type of equipment to be utilized.

The Contractor shall be required to provide appropriate personnel protective equipment for anyone who is working in an area either containing or suspected of containing a hazardous environment. This work will include both individuals physically working in these areas and those directing the work of same. Contingencies for upgrading the level of protection for on-site workers will be identified in the Health and Safety Plan and the contractor shall have the necessary materials/equipment on hand to implement the level of protection upgrade in a timely manner. Payment for this level of upgraded protection shall be paid for under Item 180.3.

## BASIS OF PAYMENT

Implementation of the Health and Safety Plan will be paid at the contract bid price per hour of implementing the plan and shall include the cost of enforcement by an on-site Safety Officer. Personnel protective clothing and equipment below Level "C" shall be considered incidental to the project and shall be a cost borne by the contractor.

**ITEM 180.3****PERSONNEL PROTECTION**  
**LEVEL C UPGRADE****HOUR**

The Contractor shall provide to all workers disposable, protective clothing appropriate to the hazard level of the work. The protective equipment and its use shall be in strict compliance with the Health and Safety Plan (Item 180.1), and all appropriate regulations that address employee working conditions.

**BASIS OF PAYMENT**

Payment for Item 180.3 will be at the contract unit price, per hour, per man, required in level 'C' personnel protection.

**ITEM 180.4****MONITORING/HANDLING AND STOCKPILING**  
**OF CONTAMINATED SOILS****CUBIC YARD**

The On-Site Safety Officer or Environmental Consultant shall be responsible for evaluating soil with non-natural discoloration, petroleum or chemical odor, the presence of petroleum liquid or sheening on the groundwater surface or any abnormal gas or materials in the ground which are known or suspected to be contaminated with oil or hazardous materials. Soil suspected of gasoline contamination shall be field tested using the jar headspace procedures according to Department of Environmental Protection Bureau of Waste Site Cleanup Interim Policy #WSC-94-400 (Remedial Waste Management Policy for Petroleum Contaminated Soil) and the Bureau of Waste Prevention Policy #COMM-97-001 (Reuse and Disposal of Contaminated Soil and Massachusetts Landfills). The Engineer shall be contacted immediately when any results indicate contamination requiring soil removal or when contamination not detectable by on-site instrumentation is suspected.

The Contractor shall be required to supply all personnel and materials necessary to comply with this section and to support the anticipated levels of protection and monitoring described above.

Within limited areas of the project site, it is likely that excavated soils may be contaminated. Where possible, all soils originally in contact with groundwater will be replaced in the same trench up to the existing groundwater level. All soils determined to be contaminated by metals or petroleum products, through the monitoring/evaluation program will be stockpiled for disposal in accordance with all Massachusetts Department of Environmental Protection statutes, policies, and regulations.

The Environmental Consultant/Contractor shall be responsible for identifying a disposal/recycling facility and obtaining all permits, approvals, Bill of Lading, etc. prior to the removal of the contaminated soil from the site. Any soils contaminated with hazardous materials that are not of petroleum origin shall be handled on a case-by-case basis. The contractor shall obtain at least three bids for the handling and disposal of any contaminated material. All manifest, bills of lading, etc. will be the responsibility of the Contractor with copies provided to the Department. The Contractor is also responsible for hiring a Licensed Site Professional (LSP), as needed, for oversight and Bills of Lading, etc.

## COMPENSATION

Measurement shall be made by the volume, in cubic yards, of contaminated material monitored, handled and/or stockpiled as described under Item 180.4.

Work under this Item shall be paid at the Contractor bid price, per cubic yard, which payment shall be considered compensation for all labor, tools, equipment and materials needed to do the work as described above.

### **ITEM 180.5**                      **LICENSED SITE PROFESSIONAL**                      **HOURLY**

A Licensed Site Professional will be required to provide the services necessary to comply with the requirements of the Massachusetts Contingency Plan (MCP), 310 CMR 40.000, with respect to the scope of work for this Contract. These services will include, but are not limited to, sampling and analysis of potentially contaminated media, preparation of IRA, URAM and RAM Plans, status reports, transmittal forms, release notification forms, completion statements and related documents required pursuant to the MCP. The LSP will be responsible for obtaining all permits related to the characterization, treatment, and disposal of contaminated media. The LSP will provide oversight of handling, stockpiling, re-use, treatment and disposal of contaminated media, including preparation of Bills of Lading, Manifests, and related shipping documents. Environmental technicians, including but not limited to personnel conducting field monitoring and sampling, data interpretation and support services directly related to MCP compliance, are also included in this Item.

The name and qualifications of the Licensed Site Professional (LSP) will be submitted to the Engineer for review and approval at least two weeks prior to initial site activities. The LSP shall have significant experience in the oversight of MCP activities at active construction sites.

The LSP will coordinate all activities with MassDOT and the Massachusetts Department of Environmental Protection through the Engineer or his/her designee.

The LSP will be responsible for adequately characterizing contaminated media to insure that it meets the requirements of the MCP and, in the case of contaminated media to be disposed of off-site, to insure that it meets the acceptance criteria set forth by the disposal facility. The LSP will be responsible for adequately characterizing subsurface conditions prior to backfill in areas where contaminated soil/sediments are excavated. The cost of laboratory analyses conducted in accordance with the sampling and assessment requirements for compliance with the MCP will be paid for within the unit bid price for Item 180.4 – Monitoring/ Handling and Stockpiling of Contaminated Soils, Item 180.6 – Soil Tests, and Item 181.1 – Disposal of Contaminated Soil.

Work under this Item shall be paid at the Contractor bid price per hour of service provided to perform the work as described above. The bid price shall reflect the cost of the LSP and any environmental technicians providing the services described above.

**ITEM 180.6****MISCELLANEOUS SOILS TESTING****EACH**

The work under this item shall conform to all relevant provisions of the Standard Specifications, the Special Provisions and the following:

The Engineer may, from time to time, direct the Contractor to obtain soil samples from various locations within the project area and to perform laboratory analyses on those soil samples to assess reuse or disposal options.

**SAMPLING AND ANALYSIS**

The Contractor shall collect discrete soil sample(s) from locations within individual soil piles or specific land area identified by the Engineer. The soil samples shall be collected at a depth specified by the Engineer. The samples shall be delivered to a Massachusetts certified laboratory using proper chain-of-custody documentation for the analysis of Resource Conservation and Recovery Act (RCRA) 8 metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polyaromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH). Subsequent testing, depending upon initial results, may be required for Toxicity Characteristic Leaching Procedure (TCLP) analyses (Method 1311) for metals.

**DATA EVALUATION AND REPORT**

The Contractor shall review and summarize the laboratory data from the soil sampling analyses. The data will be compared to Massachusetts Contingency Plan (MCP) soil standards and acceptance criteria for soil recycling and landfill disposal facilities. A letter report shall be delivered to the Engineer outlining the soil sampling methods, laboratory analyses results and proposed options for reuse or disposal of the soil.

**METHOD OF MEASUREMENT**

Miscellaneous Soil Testing shall be measured by each round of samples collected, tested and reported to the Engineer. A round of samples shall include a total of three samples.



<b><u>ITEM 181.11</u></b>	<b><u>DISPOSAL OF UNREGULATED SOIL</u></b>	<b><u>TON</u></b>
<b><u>ITEM 181.12</u></b>	<b><u>DISPOSAL OF REGULATED SOIL – IN-STATE FACILITY</u></b>	<b><u>TON</u></b>
<b><u>ITEM 181.13</u></b>	<b><u>DISPOSAL OF REGULATED</u></b>	<b><u>TON</u></b>
	<b><u>SOIL – OUT-OF-STATE FACILITY</u></b>	
<b><u>ITEM 181.14</u></b>	<b><u>DISPOSAL OF HAZARDOUS WASTE</u></b>	<b><u>TON</u></b>

**GENERAL:**

The work under these Items shall include the transportation and disposal of contaminated material excavated, or excavated and stockpiled. It shall also include the cost of any additional laboratory analyses required by a particular disposal facility beyond the standard disposal test set.

Excavation of existing subsurface materials may include the excavation of contaminated soils. The Contractor shall be responsible for the proper coordination of characterization, transport and disposal, recycling or reuse of contaminated soils. Disposal, recycling or reuse will be referred to as “disposal” for the remainder of this specification unless otherwise stated. However, regardless of the use of the term herein, there will be no compensation under these items for reuse within the project limits. The Contractor will be responsible for coordinating the activities necessary for characterization, transport and disposal of contaminated soils. Such coordination will include the Engineer and his/her designee overseeing management of contaminated materials. Contaminated soils must be disposed of in a manner appropriate for the soil classification as described below and in accordance with the applicable laws of local, state and federal authorities. The Contractor shall be responsible for identifying a disposal facility(s) licensed to accept the class of contaminated soils to be managed and assure that the facility can accept the anticipated volume of soil contemplated by the project. The Contractor shall be responsible for hiring a Licensed Site Professional (LSP) and all ancillary professional services including laboratories as needed for this work. The Contractor will be responsible for obtaining all permits, approvals, manifests, waste profiles, Bills of Lading, etc. subject to the approval of the Engineer prior to the removal of the contaminated soil from the site. The Contractor and LSP shall prepare and submit to the Engineer for approval all documents required under the Massachusetts Contingency Plan (MCP) and related laws and environmental regulations to conduct characterization, transport, and disposal of contaminated materials.

**CLASSES OF CONTAMINATED SOILS:**

The Contractor and its LSP shall determine, in accordance with Items 180.1 through 180.6, if soil excavated or soil to be excavated is unregulated soil or contaminated soil as defined in this section. Such materials shall be given a designation for purposes of reuse or disposal based on the criteria of the Massachusetts Contingency Plan (MCP). Soils and sediments which are not suitable for reuse will be given a designation for purposes of off-site disposal based on the characterization data and disposal facility license requirements. The Classes of Contaminated Soils are defined as follows:

**Unregulated Soil** consists of soil, fill and dredged material with measured levels of oil and hazardous material (OHM) contamination at concentrations below the applicable Reportable Concentrations (RCs) presented in the MCP. Unregulated soil consists of material which may be reused (or otherwise disposed) as fill within the Commonwealth of Massachusetts subject to the non-degradation criteria of the MCP (310 CMR 40.0032(3), in a restricted manner, such that they are sent to a location with equal or higher concentrations of similar contaminants. Disposal areas include licensed disposal facilities, approved industrial settings in areas which will be capped or covered with pavement or loamed and seeded, and for purposes of this project should be reused as fill within the project site construction corridor whenever possible. The material cannot be placed in residential and/or environmentally sensitive (e.g. wetlands) areas. Under no circumstances shall contaminated soils be placed in an uncontaminated or less contaminated area (including the area above the groundwater table if this area shows no sign of contamination).

The Contractor shall submit to MassDOT the proposed disposal area for unregulated soils for approval. If such a disposal area is not a licensed disposal facility, the Contractor shall submit to the Engineer analytical data to characterize the disposal area sufficiently to verify that the unregulated material generated within the MassDOT construction project limits is equal to or less than the contaminant levels at the disposal site and meets the non-degradation requirements of the MCP. In addition, the Contractor shall provide written confirmation from the owner of the proposed disposal area that s/he has been provided with the analytical data for both the materials to be disposed as well as the disposal site characterization and that s/he agrees to accept this material. **A Material Shipping Record or Bill of Lading, as appropriate, shall be used to track the off-site disposal of unregulated soil and a copy, signed by the disposal facility or property owner, shall be provided to the Engineer in order to document legal disposal of the unregulated material.**

The cost of on-site disposal of unregulated soil within the project area will be considered incidental to the item of work to which it pertains.

**Regulated Soil** consists of materials containing measurable levels of OHM that are equal to or exceed the applicable Reportable Concentrations for the site as defined by the MCP, 310 CMR 40.0000. Regulated soil which meets the MCP reuse criteria of the applicable soil/groundwater category for this project area may be reused on site provided that it meets the appropriate geotechnical criteria established by the Engineer. Regulated Soil may be reused (as daily or intermediate cover or pre-cap contouring material) or disposed (as buried waste) at lined landfills within the Commonwealth of Massachusetts or at an unlined landfill that is approved by the Massachusetts Department of Environmental Protection (DEP) for accepting such material, in accordance with DEP Policy #COMM-97-001, or at a similar out-of-state facility. It should be noted that soils which exceed the levels and criteria for disposal at in-state landfills, as outlined in COMM-97-001, may be shipped to an in-state landfill, but require approval from the DEP Division of Solid Waste Management and receiving facility. An additional management alternative for this material is recycling into asphalt. Regulated Soils may also be recycled at a DEP approved recycling facility possessing a Class A recycling permit subject to acceptance by the facility and compliance with DEP Policy #BWSC-94-400. **Regulated Soil removed from the site for disposal or treatment must be removed via an LSP approved Bill of Lading, Manifest or applicable material tracking form.** This type of facility shall be approved/permitted by the State in which it operates to accept the class of contaminated soil in accordance with all applicable local, state and federal regulations.

**Hazardous Waste** consists of materials which must be disposed of at a facility permitted and operated in full compliance with Federal Regulation 40 CFR 260-265, Massachusetts Regulation 310 CMR 30.000, Toxic Substances Control Act (TSCA) regulations, or the equivalent

regulations of other states, and all other applicable local, state, and federal regulations. All excavated materials classified as hazardous waste shall be disposed of at an out-of-state permitted facility. This facility shall be a RCRA hazardous waste or TSCA facility, or RCRA hazardous waste incinerator. This type of facility shall be approved/permitted by the State in which it operates to accept hazardous waste in accordance with all applicable local, state and federal regulations and shall be permitted to accept all contamination which may be present in the soil excavate. The Contractor shall ensure that, when needed, the facility can accept TSCA waste materials i.e. polychlorinated biphenyls (PCBs). **Hazardous waste must be removed from the site for disposal or treatment via an LSP approved Manifest.**

#### MONITORING/SAMPLING/TESTING REQUIREMENTS:

The Contractor shall be responsible for monitoring, sampling and testing during and following excavation of contaminated soils to determine the specific class of contaminated material. Monitoring, sampling and testing frequency and techniques should be performed in accordance with Items 180.1 through 180.6,. Additional sampling and analysis may be necessary to meet the requirements of the disposal facility license. The cost of such additional sampling and analysis shall be included in the bid cost for the applicable disposal items. The Contractor shall obtain sufficient information to demonstrate that the contaminated soil meets the disposal criteria set by the receiving facility that will accept the material.

No excavated material will be permanently placed on-site or removed for off-site disposal until the results of chemical analyses have been received and the materials have been properly classified. The Contractor shall submit to the Engineer results of field and laboratory chemical analyses tests within seven days after their completion, accompanied by the classification of the material determined by the Contractor, and the intended disposition of the material. The Contractor shall submit to the Engineer for review all plans and documents relevant to LSP services, including but not limited to, all documents that must be submitted to the DEP.

Copies of the fully executed Weight Slips/Bills of Lading/Manifests/Material Shipping Records or other material tracking form received by the Contractor from each disposal facility and for each load disposed of at that facility, shall be submitted to Engineer and the Contractor's LSP within three (3) days of receipt by the Contractor. The Contractor is responsible for preparing and submitting such documents for review and signature by the LSP or other appropriate person with signatory authority, three (3) days in advance of transporting soil off-site. The Contractor shall furnish a form attached to each manifest or other material tracking form for all material removed off-site, certifying that the material was delivered to the site approved for the class of material. If the proposed disposition of the material is for reuse within the project construction corridor, the Contractor shall cooperate with MassDOT to obtain a suitable representative sample(s) of the material to establish its structural characteristics in order to meet the applicable structural requirements as fill for the project.

All material transported off-site shall be loaded by the Contractor into properly licensed and permitted vehicles and transported directly to the selected disposal or recycling facility and be accompanied by the applicable shipping paper. At a minimum, truck bodies must be structurally sound with sealed tail gates, and trucks shall be lined and loads covered with a liner, which shall be placed to form a continuous waterproof tarpaulin to protect the load from wind and rain.

#### DECONTAMINATION OF EQUIPMENT:

Tools and equipment which are to be taken from and reused off site shall be decontaminated in accordance with applicable local, state and federal regulations. This requirement shall include, but not be limited to, all tools, heavy machinery and excavating and hauling equipment used during excavation, stockpiling and handling of contaminated material. Decontamination of equipment is considered incidental to the applicable excavation item, Item 180.4 and this Item.

#### REGULATORY REQUIREMENTS:

The Contractor shall be responsible for adhering to regulations, specifications and recognized standard practices related to contaminated material handling during excavation and disposal activities. MassDOT shall not be responsible at any time for the Contractor's violation of pertinent State or Federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts Department of Environmental Protection, the U.S. Environmental Protection Agency, Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing the disposal of contaminated soils.

All labor, materials, equipment and services necessary to make the work comply with such regulations shall be provided by the Contractor without additional cost to MassDOT. Whenever there is a conflict or overlap within the regulations, the most stringent provisions are applicable. The Contractor shall reimburse MassDOT for all costs it incurs, including penalties and/or for fines, as a result of the Contractor's failure to adhere to the regulations, specifications, recognized standard practices, etc., that relate to contaminated material handling, transportation and disposal.

#### SUBMITTALS:

**I. Summary of Sampling Results, Classification of Material and Proposed Disposal Option.** The following information, presented in tabular format, must be submitted to the Engineer for review and approval prior to any reuse on-site or disposal off-site. This requirement is on-going throughout the project duration. At least two weeks prior to the start of any excavation activity, the Contractor shall submit a tracking template to be used to present the information as stipulated below. Excavation will not begin until the format is acceptable to MassDOT.

Characterization Reports will be submitted for all soil, sediment, debris and groundwater characterized through the sampling and analysis programs required under Items 180.4, 180.6, and 181.11 – 181.14. Each report will include a site plan which identifies the sampling locations represented in the Report. The Construction Plan sheets may be used as a baseplan to record this information.

The Sampling Results will be presented in tabular format. Each sample will be identified by appropriate identification matching the sample identification shown on the Chain of Custody Record. The sample must also be identified by location (e.g. grid number or stockpile number). For each sample, the following information must be listed: the classification (unregulated, regulated, etc.), proposed disposal option for the stockpile or unit of material represented, and, all analytical results.

Each Characterization Report will include the laboratory analytical report and Chain of Custody Record for the samples included in the Report.

**II. Stockpiling, Transport, and Disposal.** At least two weeks prior to the start of any excavation activity, the Contractor shall submit, in writing, the following for review and shall not begin excavation activity until the entire submittal is acceptable to MassDOT.

**A. Excavation and Stockpiling Protocol:**

Provide a written description of the management protocols for performing excavation and stockpiling and/or direct loading for transport, referencing the locations and methods of excavating and stockpiling excavated material in accordance with Items 180.1 through 180.5.

**B. Disposal and Recycling Facilities:**

1. Provide the name, address, applicable licenses and approved waste profile for disposal and recycling location(s) where contaminated soil will be disposed. Present information substantiating the suitability of proposed sites to receive classifications of materials intended to be disposed there, including the ability of the facility to accept anticipated volumes of material.
2. Provide a summary of the history of compliance actions for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. Material should not be sent to facilities which are actively considered by the DEP, USEPA or other responsible agency to be in violation of federal, state or local hazardous waste or hazardous material regulations. MassDOT reserves the right to reject any facility on the basis of poor compliance history.

**C. Transportation:**

The name, address, applicable license and insurance certificates of the licensed hauler(s) and equipment and handling methods to be used in excavation, segregation, transport, disposal or recycling.

**III. Material Tracking and Analytical Documentation for Reuse/Disposal**

The following documents are required for all excavation, reuse and disposal operations and shall be in the format described. At least two weeks prior to the start of any excavation or demolition activity, the Contractor shall submit the tracking templates required to present the information as stipulated below. Excavation or demolition will not begin until the format is acceptable to MassDOT.

All soils, sediments and demolition debris must be tracked from the point of excavation to stockpiling to onsite treatment/processing operations to off-site disposal or onsite reuse as applicable.

1. Demolition Debris. Demolition debris must be tracked if the debris is stockpiled at a location other than the point of origin or if treatment or material processing is conducted. Identification of locations will be based on the station-offset of the location. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations/comments, quantity, and stockpile ID/processing operation location. For each unit of material tracked, the table will also track reuse of the material on-site, providing reuse date, location of reuse as defined by start and end station, width of reuse location by offset, the fill elevation range, quantity, and finish grade for said location. For demolition debris which is not reused on site, the table will also track disposal of the material as defined by disposal date, quantity and disposal facility. The table must provide a reference to any analytical data generated for the material.
2. Soil/Sediment. Soil excavation will be identified based on the station-offset of the excavation location limits. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations, quantity, and stockpile number/location. For each unit of material tracked, the table will also track reuse of the material on-site and disposal of the material offsite using the same categories identified for demolition debris above.

**BASIS OF PAYMENT AND METHOD OF MEASUREMENT FOR ITEMS 181.11 THROUGH 181.14:**

Disposal of contaminated soil shall be measured for payment by the Ton of actual and verified weight of contaminated materials removed and disposed of. The quantities will be determined only by weight slips issued by and signed by the disposal facility. The most cost-effective, legal disposal method shall be used.

- Item 181.11 Measurement for Disposal of Unregulated Soil shall be under the Contract Unit Price by the weight, in Tons (TN), of contaminated materials removed from the site and transported to and disposed of at an approved location or licensed facility, and includes any and all costs for approvals, permits, fees and taxes, additional testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.
- Item 181.12 Measurement for Disposal of Regulated Soil – In-State Facility shall be under the Contract Unit Price by the weight, in Tons (TN), of contaminated materials removed from the site and transported to and disposed of at an approved in-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

- Item 181.13 Measurement for Disposal of Regulated Soil - Out-of-State Facility shall be under the Contract Unit Price by the weight, in Tons (TN), of contaminated materials removed from the site and transported to and disposed of at an approved out-of-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.
- Item 181.14 Measurement for Disposal of Hazardous Waste shall be under the Contract Unit Price by the weight, in Tons (TN), of hazardous waste removed from the site and transported to and disposed of at the licensed hazardous waste facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

### **ITEM 181.2 BATTERY WELL AND SIGNAL BOX REMOVE AND DISCARD EACH**

The work under this Item shall include the removal and disposal of battery wells and signal boxes and their contents. Removal of the contaminated material excavated around them will be paid for separately under Items 181.11 – 181.14.

The battery wells and signal boxes represent potential Recognized Environmental Conditions (RECs) defined of a past, current, or future potential release of oil and hazardous material (OHM) at or affecting the BFRT due to the use of chemicals.

An environmental site assessment was conducted along Phase 2 of the Bruce Freeman Rail Trail. Soil samples were collected from five representative battery wells and signal boxes. Four (4) battery wells and six (6) signal boxes fall within this project and are located at: Station 47+77 (Signal Box), 113+89 (Signal Box), 113+96 (Battery Well), 603+08 (Signal Box), 603+40 (Signal Box), 205+00 (Battery Well), 234+40 (Battery Well), 246+62 (Battery Well), 248+52 (Signal Box) and 248+61 (Signal Box).

The battery wells typically consist of an approximately 2-foot diameter concrete cylinder open on the bottom to underlying soil and covered with a metal lid. Soil in and around the battery wells contained polycyclic aromatic hydrocarbons (PAHs) and metals including arsenic, cadmium, lead, nickel and mercury above MCP soil category S-1 reportable concentrations (RCS-1). The lead and arsenic are likely attributable to the application of pesticides. The lead and PAHs may also be attributable to coal ash.

Soil in and around the signal boxes contained extractable petroleum hydrocarbons (EPH), polychlorinated biphenyls (PCBs) and metals.

Batteries, resembling automobile batteries, were still present in some of the battery wells and signal boxes. The batteries contained an acid solution with a layer of oil on top to prevent evaporation. Based on the age of the railroad, oil in the signal batteries, the batteries have the potential to contain PCBs.

**REGULATORY REQUIREMENTS:**

The Contractor shall be responsible for adhering to regulations, specifications and recognized standard practices related to contaminated material handling during excavation and disposal activities. MassDOT shall not be responsible at any time for the Contractor's violation of pertinent State or Federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts Department of Environmental Protection, the U.S. Environmental Protection Agency, Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing the disposal of contaminated materials.

All labor, materials, equipment and services necessary to make the work comply with such regulations shall be provided by the Contractor without additional cost to MassDOT. Whenever there is a conflict or overlap within the regulations, the most stringent provisions are applicable. The Contractor shall reimburse MassDOT for all costs it incurs, including penalties and/or for fines, as a result of the Contractor's failure to adhere to the regulations, specifications, recognized standard practices, etc., that relate to contaminated material handling, transportation and disposal.

**COMPENSATION**

Battery well and signal box remove and discard shall be measured for payment per each removed, complete in place.

Battery well and signal box remove and discard shall be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 183.1      TREATMENT OF CONTAMINATED GROUNDWATER      GALLON**

The Contractor is advised that contaminated groundwater may be encountered during excavations. It is likely that treatment of the contaminated groundwater using liquid phase granular activated carbon will be required to complete the work under this Contract. The Methods described under Item 183.1 provide for the identification, testing, management and treatment or disposal of contaminated groundwater and shall be implemented, at a minimum and as necessary by the Contractor via Methods under Item 183.1.

It is not the intent herein for the Department to design for or specify to the Contractor which particular treatment is to be used, if necessary. Rather, it is the Department's intent to provide guidance to the Contractor for informational and bidding purposes only. It is, therefore, the Contractor's responsibility to use a treatment method which allows him/her to meet any and all laws, regulations, policies, guidelines and permit requirements.

The overall handling and management of contaminated groundwater is regulated by DEP under the provisions of 310 CMR 40.000. The unpermitted discharge of contaminated dewatering effluent into the environment (storm drain, surface water body, onto the ground) is a violation of several federal and state laws and regulations.



Should dewatering of contaminated groundwater be necessary, approvals must be sought from the appropriate regulatory jurisdiction prior to initiating any dewatering activity.

There are basically four options available:

1. Pump to a tight tank or "vacuum truck", with subsequent treatment/disposal at an off-site approved facility;
2. Discharge to a sanitary sewer with appropriate permit from local and regional sewerage authorities and DEP;
3. Discharge to a storm drain or surface water body with permit or approval from DEP and/or the US EPA; or
4. Discharge to the ground with the approval from DEP.

Generally, the utilization of options (2) through (4) involves treating the contaminated groundwater prior to discharge. Treatment of contaminated groundwater for dewatering operations is generally performed using a mobile treatment trailer equipped with one or more granular-activated carbon (GAC) canisters, although other techniques are also used.

For short-term operations, treatment and discharge to a surface water body/storm drain may be the most cost-effective and expedient alternative. In such cases, a short-term exemption from the permitting provisions of the National Pollutant Discharge Elimination System (NPDES) may be approved by the US EPA, via the Regional Office in Lexington, Massachusetts.

The US EPA will not specify a treatment system or method but normally requires that the treated discharge water meets Massachusetts Drinking Water Standards. The discharge standards are normally met by treating the dewatered groundwater through granular activated carbon canisters, or similar techniques.

The Contractor shall be responsible for determining compliance with the requirements of the obtained Permit and for any sampling, testing, and disposal required in connection with said Permit. The Contractor is also advised that additional requirements may be administered by the local sewer authority. The Massachusetts Highway Department and the City reserve the right to collect additional samples of dewatered groundwater to determine the Contractor's compliance with the Permit's requirements.

Longer term discharges to surface waters or storm drains, and any discharge to the ground, require approval and/or issuance of the provisions of 314 CMR 3.00 and 5.00, respectively. In such cases, contact: DEP, Division of Water Pollution Control, One Winter Street, Boston, MA 02108.

For the purpose of these specifications, and to establish a basis for the bid, it is anticipated that liquid-phase granular-activated carbon will be the treatment medium for dewatered contaminated groundwater. The bidder shall factor into the payment item all costs associated with the testing and analyses that may be required by the permitting agency. In addition, any laboratory testing of groundwater is to be performed by a DEP certified laboratory for the parameters being tested. Copies of all field and laboratory testing results will be supplied to the Engineer. Bid price shall also include full compensation for labor, materials, maintenance, mobilization, rental and other related costs. Item 183.2 will be used for disposal of used granular-activated carbon canisters.

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**COMPENSATION**

Treatment of contaminated groundwater will be measured for payment by the gallon of contaminated groundwater pumped through granular activated carbon (GAC) canisters or other treatment medium.

Treatment of contaminated groundwater will be paid for at the Contract unit price per gallon, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

Disposal of liquid-phase granular-activated carbon shall be paid for separately under Disposal of Granular Activated Carbon, Item 183.2.

**ITEM 183.2      DISPOSAL OF GRANULAR ACTIVATED CARBON      POUND**

Work under Item 183.2 is based upon the disposal of granular activated carbon used as the treatment medium for contaminated groundwater found during excavations.

**COMPENSATION**

Disposal of granular activated carbon will be measured for payment by the pound of carbon used.

Disposal of granular activated carbon will be paid for at the Contract unit price per pound, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

All other costs associated with treatment of contaminated groundwater will be covered under Treatment of Contaminated Groundwater, Item 183.1,

**ITEM 184.1      DISPOSAL OF TREATED WOOD PRODUCTS      TON****DESCRIPTION**

This section shall apply to the disposal of all treated wood. The timber rail ties are suspected to be treated with either creosote, pentachlorophenol and/or CCA. This item shall include all costs for sampling, laboratory testing, loading, transportation and disposal of the treated wood to a waste-to-energy facility that is licensed to burn treated wood. The Contractor is required to submit manifests and certificates of destruction to the Engineer prior to the completion of the project. All aspects of this Item are to be completed in accordance with state and federal regulations.

In addition, this item shall account for the removal and proper disposal of all bridge timber rail ties. Bridge timber rail ties shall be considered those located on existing steel beams as well as any timber placed on top of the adjoining stone masonry abutments and wingwalls.

## COMPENSATION

Disposal of treated wood products will be measured for payment by the ton of treated timber removed and subsequently accepted at the waste-to-energy facility.

Disposal of treated wood products will be paid for at the Contract unit price per ton, which price shall include all labor, materials equipment, and incidental costs required to complete the work. No separate payment will be made for testing, loading, transportation, approvals, and permits, but all costs in connection therewith shall be included in the Contract unit price bid.

### **ITEM 189.2**

### **ABANDONMENT OF SEPTIC SYSTEM**

### **LUMP SUM**

The work shall include the abandonment of the septic system located at Station 113+00, LT as shown on the plans either by removal or closure in place, and shall include sampling and disposal of any contaminated materials associated with Item 189.2. The Contractor shall follow all the rules and regulations stated herein. The Contractor shall also notify and coordinate his/her efforts with the proper local Board of health and utilities accordingly.

The State Environmental Code, Title 5, 310 CMR 15 and the Local Board of Health regulate the installation and abandonment of septic systems. All disposal and sampling of contaminated material shall comply with all current state, federal and local regulations, including but not limited to 310 CMR 30.000 and 310 CMR 40.000.

All necessary permits and inspections shall be acquired by the Contractor. Prior to removing the existing septic system, the Contractor shall have a licensed Sewage Disposal Contractor, as approved by the Engineer, pump out the tank. The tank should be decommissioned per 310 CMR 15.354 with the Local Board of Health Inspector present.

- 1) The tank should be excavated and removed, OR
- 2) Puncture the bottom of the tank so it will not hold water and then fill with sand.

All documentation should be retained by the Department/Facility for a minimum of five (5) years.

## COMPENSATION

The cost of materials, tools, equipment, and labor is to be paid for in lump sum for the complete pumping, removal or destruction of any contaminated soil/liquid and filing of permits necessary to complete the project.

Abandonment of septic system will be paid for at the Contract unit price per lump sum, which price shall include all labor, materials, equipment and incidental costs required to complete the work. All costs in connection with the protection of the general public, private property and proper disposal of any material removed shall be considered as included in the price and no additional compensation will be allowed.

<b><u>ITEM 238.06</u></b>	<b><u>6 INCH DUCTILE IRON PIPE</u></b>	<b><u>FOOT</u></b>
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The work under this item shall conform to the relevant provisions of Section 230 of the Standard Specifications.

<b><u>ITEM 252.08</u></b>	<b><u>8 INCH CORRUGATED PLASTIC (POLYETHYLENE) PIPE</u></b>	<b><u>FOOT</u></b>
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The work under this item shall conform to the relevant provisions of Section 230 of the Standard Specifications.

<b><u>ITEM 431.1</u></b>	<b><u>HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE</u></b>	<b><u>CUBIC YARD</u></b>
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The work under this item shall conform to the relevant provisions of Section 430 of the Standard Specifications and the following:

The work shall include the furnishing and placing of high early strength cement concrete base course for narrow roadway widening as shown on the plans and as directed by the Engineer.

**COMPENSATION**

High early strength cement concrete will be measured for payment by the cubic yard, complete in place.

High early strength cement concrete will be paid for at the Contract unit price per cubic yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

<b><u>ITEM 450.90</u></b>	<b><u>CONTRACTOR QUALITY CONTROL</u></b>	<b><u>TON</u></b>
<b><u>ITEM 451.</u></b>	<b><u>HMA FOR PATCHING</u></b>	<b><u>TON</u></b>
<b><u>ITEM 452.</u></b>	<b><u>ASPHALT EMULSION FOR TACK COAT</u></b>	<b><u>GALLON</u></b>
<b><u>ITEM 453.</u></b>	<b><u>HMA JOINT SEALANT</u></b>	<b><u>FOOT</u></b>
<b><u>ITEM 455.23</u></b>	<b><u>SUPERPAVE SURFACE COURSE – 12.5 (SSC-12.5)</u></b>	<b><u>TON</u></b>
<b><u>ITEM 455.31</u></b>	<b><u>SUPERPAVE INTERMEDIATE COURSE – 12.5 (SIC-12.5)</u></b>	<b><u>TON</u></b>
<b><u>ITEM 455.32</u></b>	<b><u>SUPERPAVE INTERMEDIATE COURSE – 19.0 (SIC-19.0)</u></b>	<b><u>TON</u></b>
<b><u>ITEM 455.42</u></b>	<b><u>SUPERPAVE BASE COURSE – 37.5 (SBC-37.5)</u></b>	<b><u>TON</u></b>
<b><u>ITEM 455.61</u></b>	<b><u>SUPERPAVE BRIDGE SURFACE COURSE - 12.5 (SSC-B - 12.5)</u></b>	<b><u>TON</u></b>
<b><u>ITEM 455.71</u></b>	<b><u>SUPERPAVE BRIDGE PROTECTIVE COURSE -12.5 (SPC-B - 12.5)</u></b>	<b><u>TON</u></b>

Work under these Items shall conform to the relevant provisions of Document 00717 SUPERPAVE REQUIREMENTS contained herein and the following:

The Equivalent Single Axle Loads (ESALs) for the design travel lane over a 20-year period, is XX.X Million 18-kip (80-kn) ESALs. The PGAB Grade selected for this Contract is PG XX-XX.

**ITEM 482.31****SAWING AND SEALING JOINTS IN ASPHALT  
PAVEMENT AT BRIDGES****FOOT**

Work under this Item shall consist of saw-cutting, cleaning and sealing approach joints on the bridge in the newly installed hot mix asphalt pavement. The intent of this work is to establish a weakened plane joint to control reflective cracking in the newly installed hot mix asphalt pavement.

**MATERIAL**

Joint sealing material shall be an asphalt rubber compound of the hot poured type conforming to the requirements of subsection M3.05.4 & (ASTM D30405) with minimum 15% ground reclaimed tire rubber.

**CONSTRUCTION DETAILS - GENERAL**

Locate and reference the location of each joint prior to the placement of the hot mix asphalt. Do not perform saw-cutting until the hot mix asphalt has thoroughly cooled. Perform saw-cutting within seven (7) days after placement and before any evidence of reflective cracking has developed.

**SAW-CUTTING OF TRANSVERSE JOINTS**

The hot mix asphalt shall have aged sufficiently to allow a clean cut to be made and to withstand the eroding effects of the saw or other cutting devices.

The sawcut portion of the joint shall be made with an approved power driven saw. The blade or blades shall be of such size and configuration that the desired dimensions or the sawcut can be made with one pass. The sawcut shall be made with an abrasive blade and sawn dry or with a diamond blade and sawn wet. If wet sawing is used, immediately flush the reservoir with water.

Wet sawed joints shall be thoroughly cleaned with a water blast to remove any sawing slurry, dirt or deleterious matter adhering to the joint walls or remaining in the joint cavity. The joints shall then be blown with air to provide dry joint surfaces prior to sealing. A Hot-Air-Lance shall be used for this operation. Dry sawed joints shall be thoroughly cleaned with a stream of air sufficient to remove any dirt, dust and deleterious matter adhering to the joint walls or remaining in the cavity.

The Contractor shall sawcut joints to the appropriate dimensions based on the existing pavement slab length and new overlay depth.

When the total depth of the overlay exceeds 4.5", including scratch or leveling course, make a 1/8" wide sawcut to a minimum depth of 2.5" or one-third (1/3) of the total overlay thickness, whichever is greater. Saw a reservoir in the wearing course having a width of 3/8" (1/2" at bridge joints) and a depth of 3/4".

The Contractor shall conduct his/her operations so that saw-cutting of joints, cleaning, and sealing is a continuous operation.

Traffic shall not be allowed to knead together or damage the sawed joints. Sawed joints shall be filled and cured prior to opening to traffic. Sawed joints not sealed before traffic is allowed on the overlay shall be re-sawn when sawing and sealing operations resume at no additional costs to the Department.

### SEALING

After cleaning, and just prior to sealing, bond breaker tape shall be placed in the bottom of the sawcut joint. Bond breaker tape shall consist of regular masking tape or a suitable bond breaker tape designed for use with hot poured sealants. The width of the tape may be equal to but not more than 1/8" narrower than the width of the sawcut.

### EQUIPMENT

Equipment used in the performance of the work required by this section of the specification shall be approved by the Engineer and maintained in a satisfactory working condition at all times.

The joint sealing material shall be heated in a kettle or melter constructed as a double boiler, with a space between the inner and outer shells filled with oil or other heat transfer medium. The equipment shall include positive temperature controls, automatic and continuous mechanical agitation, recirculation pumps and thermometers for the continuous reading of temperature of both the sealing compound and the heat transfer medium. The melter shall be equipped with a thermostat to maintain the sealing compound within the range of temperatures specified by the manufacturer.

Air compressor: Air Compressors shall be portable and capable of furnishing no less than 185 ft<sup>3</sup> of air per minute at no less than 130 psi pressure at the nozzle. (If the velocity of this unit is not sufficient enough to thoroughly clean the joint, as determined by the Engineer, a Hot-Air-Lance must be used.) The compressor shall be equipped with traps that will maintain the compressed air free of oil and water.

The joint sealant shall be applied with a mobile carriage and a rubber or metal shoe and have a flow control valve which allows all joints to be filled to refusal, so as to eliminate all voids or entrapped air, and not to leave unnecessary surplus joint sealant on the pavement surface. Pour pots or similar devices shall not be used to fill sawed joints. The joint sealant shall completely fill the joint such that after cooling, the level of the sealant will not be greater than 1/8" below the pavement surface.

Any depression in the sealant greater than 1/8" shall be brought up to the specified limit by the further addition of joint sealer. Overfilling of the joints will not be allowed and spillage of the sealant shall be avoided.

Sand shall not be spread on the sealed joints to allow early opening to traffic. Sealants shall be tack free prior to opening to traffic.

Boiler Slag Aggregate: Black Beauty should be used at locations deemed necessary by the Engineer (i.e. Intersections of high volume traffic.)

## PREPARATION

General: No joint sealing material shall be applied in wet joints or where frost, snow or ice is present nor when ambient temperatures are below 40°F. Any given quantity of material shall never be heated at the pouring temperature for more than six (6) hours and shall not be reheated more than once.

All joints, as determined by the Engineer, to be dried or rejuvenated shall be heated, prior to application of sealant, with a Hot-Air-Lance which operates at 1995°F at 1970 feet per second velocity. The lance shall have no exit flame which burns the asphalt.

## COMPENSATION

Sawing and sealing joints in asphalt pavement at bridges will be measured for payment by the foot on the pavement surface, complete in place.

Sawing and sealing joints in asphalt pavement at bridges will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

### ITEM 620.2

### STEEL W BEAM HIGHWAY GUARD (SINGLE FACED) – RUB RAIL

### FOOT

The work under this item shall conform to the relevant provisions of Section 601 of the Standard Specifications and the following:

This work shall install standard W beam highway guardrail and a premium pressure treated timber rail (rub rail) at the back side of the guard rail post, adjacent to the road or traveled way.

## CONSTRUCTION

The timber rail shall be 2"x6" (nominal dimensions) premium (No. 1) pressure treated. Timber length shall be such that ends of rail are located on guard rail posts. Connecting hardware shall be galvanized and shall conform to ASTM A 123-78. Bolts shall be approximately 1/2"x4" with two (2) bolted connections per rail per every guard rail post. Lap posts shall have four (4) bolted connections. Bolt heads shall be countersunk or of a carriage bolt type. Bolt and nut shall be treated to prevent nuts from backing out.

## COMPENSATION

Steel beam highway guard (single faced) – rub rail will be measured for payment by the foot, complete in place.

Steel beam highway guard (single faced) – rub rail will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 639.****PRIVACY SCREEN****FOOT**

The work under this item shall conform to the relevant provisions of Section 644 of the Standard Specifications and the following:

**DESCRIPTION**

The work shall consist of providing and installing a black privacy screen on the 96" Chain Link Fence (PTR) Vinyl Coated (Line Post Option) around the Rex Lumber property as shown on the plans and as directed by the Engineer.

Privacy Screen shall have a tight weave pattern with a 90% visibility blockage. It shall be made from high grade closed mesh polypropylene enhanced with UV inhibitors to reduce color fading. The screen should be finished with binding and grommets on all four sides to ensure a durable, clean fit. The material break strength shall meet or exceed: Warp Tensile 420 pounds, Warp Tear 125 pounds.

The privacy screen shall be stretched taut and securely fastened to the posts. The privacy screen shall be black.

**COMPENSATION**

Privacy screen will be measured for payment by the foot, complete in place.

Privacy screen will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 645.196 96 INCH CHAIN LINK FENCE (PTR) VINYL COATED**  
**(LINE POST OPT.)****FOOT**

The work under this item shall conform to the relevant provisions of Section 644 of the Standard Specifications and the following:

**DESCRIPTION**

The work shall consist of providing and installing chain link fence (line post option) with a black privacy screen as shown on the plans and as directed by the Engineer.

The work shall include all end, corner and intermediate posts, excavation and backfilling of post holes, foundations, additional cross bracing, special cutting, fabrication and a mesh black privacy screen.

Chain Link fence will have a black vinyl coating.



Privacy Screen shall have a tight weave pattern with a 90% visibility blockage. It shall be made from high grade closed mesh polypropylene enhanced with UV inhibitors to reduce color fading. The screen should be finished with binding and grommets on all four sides to ensure a durable, clean fit. The material break strength shall meet or exceed: Warp Tensile 420 pounds, Warp Tear 125 pounds.

The privacy screen shall be stretched taut and securely fastened to the posts. The privacy screen shall be black.

### COMPENSATION

96 inch chain link fence (PTR) vinyl coated (line post opt.) with screening will be measured for payment by the foot, complete in place.

96 inch chain link fence (PTR) vinyl coated (line post opt.) with screening will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for end, corner or intermediate posts, excavation and backfilling of post holes, concrete foundations, additional cross bracing, cutting, fabrication or the black privacy screen, but all costs in connection therewith shall be included in the Contract unit price bid.

**ITEM 655.01**  
**ITEM 655.02**  
**ITEM 655.03**

**TIMBER RAIL FENCE**  
**TIMBER RAIL FENCE ON BRIDGE**  
**TIMBER RAIL POST – 54” TALL**

**FOOT**  
**FOOT**  
**EACH**

The work under this item shall include the fabrication and installation of timber rail fence, timber rail fence on bridge and timber rail post – 54” as dimensioned and where shown on the plans, as directed by the Engineer and as follows:

### MATERIALS

Materials shall meet the requirements specified in the following Subsection of Division III, Materials and the following:

Gravel Borrow	M1.03.0 – Type b
Wooden Rails and Posts	M9.05.3
Timber Preservatives	M9.05.5

Galvanized connections, bolts, washers and nuts shall conform to AASHTO M 232.

Connection angles at post base on bridge shall be galvanized according to AASHTO M 111.

## CONSTRUCTION

### Timber Rail Fence Fabrication and Erection

All posts for timber rail fence shall be machine driven provided that posts are not damaged in the process. If a post cannot be machine driven, it shall be set plumb in mechanically excavated or cored holes and secured in gravel borrow footings according to the plans. Posts shall be spaced as shown on the plans. In setting the posts, precautions shall be taken to ensure proper offset, alignment and leveling to prevent bending or twisting of the rail.

Posts for timber rail fence mounted on wall shall be set plumb in steel sleeves integrally cast into concrete wall and sealed with grout. Posts shall extend securely from the bottom of the sleeve to the required height. Posts shall be spaced as shown on the plans. In setting the posts, precautions shall be taken to ensure proper offset, alignment and leveling to prevent bending or twisting of the rail.

Posts for Timber Rail Fence on Bridge shall be set plumb and placed flat on the concrete curb. Posts shall extend securely from the top of the curb to the required height. Posts shall be spaced as shown on the plans. In setting the posts, precautions shall be taken to ensure proper offset, alignment and leveling to prevent bending or twisting of the rail.

Butt joints shall be used for all rail splices. Two (2) bolts shall be used per each rail/post connection.

All connections, screws, bolts, nuts, and washers shall be galvanized.

All posts and rails shall be ACQ treated. Posts shall have a preservative retention level of 0.60 and rails shall have a minimum preservative retention level of 0.40.

## COMPENSATION

Timber rail fence and timber rail fence on bridge will be measured for payment by the foot complete in place.

Timber rail fence and timber rail fence on bridge will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for gravel borrow, wooden rail and posts, timber preservatives for post buried ends and all required hardware and connection plates, but all costs in connection therewith shall be included in the Contract unit price bid.

**ITEM 656.****REMOVE AND RESET ELECTRIC  
GATE AND EQUIPMENT****LUMP SUM**

The work to be done under this item shall conform to the relevant provisions of Section 665, Section 901 and the following:

The work consists of removing the existing electric gate and equipment located at the Rex Lumber entrance at the end of Rex Lane and reset it at the location indicated on the plans. The gate shall be attached to the existing fencing in the new location. If additional fencing is required, the Contractor shall provide it at no additional cost to the Department.

The Contractor is responsible for any damage upon removal or resetting of gate and shall replace any damaged material in kind or equal with no additional compensation.

The Contractor shall furnish and place the necessary concrete foundations required to complete the installation in a satisfactory manner.

The new concrete foundations shall be poured to the same dimensions, or larger, as the foundations that are at the existing location of gate.

**COMPENSATION**

Remove and reset electric gate and equipment will be paid for at the Contract unit price per lump sum, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 660.010****RAILINGS****FOOT****GENERAL**

The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install handrails in accordance with the requirements of 521 CMR 24.00 Ramps, complete, as indicated on the Contract Documents, as specified, and as follows.

**Reference Standards**

The following standards, specifications and codes are incorporated in their latest edition.

American Welding Society (AWS) standards:

AWS D1.0, "Code for Welding in Building Construction"

AWS D1.1, "Structural Welding Code - Steel"

American Iron and Steel Institute (AISI) listed standards.

American Institute of Steel Construction (AISC) listed standards.

Steel Structures Painting Council (SSPC) listed standards.

SSPC Steel Structures Painting Council (SSPC):

- SP1 Solvent Cleaning
- SP6 Commercial Blast Cleaning
- SP7 Brush-off Blast Cleaning
- SP 11 Power Tool Cleaning to Bare Metal
- PA 2 Measurement of Dry Coating Thickness with Magnetic Gages

Federal Standards

Standard No. 595B, Colors Volume 1

ASTM American Society for Testing and Materials

- D523-89 Standard Test Method for Specular Gloss
- D4541-95e1 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- D4285-83 Standard Test Method for Indicating Oil or Water in Compressed Air
- D3359 Standard Test Method for Measuring Adhesion by Tape Test
- D3363 Standard Test Method for Film Hardness by Pencil Test

FSC Forest Stewardship Council

In case of conflict between a Reference Standard and the Specifications, the Specifications shall govern. In the case of conflict between Reference Standards, the more stringent shall govern.

When compliance with any Reference Standard is specified herein for materials (or a product, manufactured or fabricated), the CONTRACTOR, if requested, shall submit an affidavit from the manufacturer (or fabricator) certifying that the materials (or product) delivered to the job meets the requirements specified. Such certification, however, shall not relieve the CONTRACTOR from the responsibility of complying with other requirements specified in this Section.

### SUBMITTALS

The CONTRACTOR shall submit the following:

Shop drawings for all work verifying all field conditions and dimensions. The Engineer shall approve all submittals. Details shall show proposed methods of anchorage, connection, attachment, splicing or interface between the work of this section and adjacent new work of other sections or existing work. Indicate proposed form and type of welds using standard AWS symbols.

Metal Fabricator shall provide proposed rail Layout Drawings to the Engineer for review and acceptance prior to submitting to the general contractor for use during layout of anchorage castings within the new ramp.

Following completion of new ramp, the Metal Fabricator shall create an As-Built Layout Drawing of installed anchor rod assemblies for their use during shop fabrication.

Provide Layout Drawings consisting of dimensioned plans for new rail and posts. As requested by the Engineer, provide additional details and sections to fully describe the work to be provided.

Product Information: For epoxy filler material. Literature shall include detailed product description and data for installation methods and procedures.

Mock Ups: Rail. Supply and install in location designated by the Engineer on the project site one full rail section and its supporting stanchions complete with all mounting and attachment for review and approval by the Engineer.

Samples: Prepare at the job site 12-inch by 12-inch color samples of paint applied on same surface material as will be used in the work.

#### Product Handling

Deliver materials and cast/fabricated components to the job site in good condition and properly protected against damage to finished surfaces. Manufactured materials shall be delivered and stored in their original containers. All off-site fabricated steel components shall be prepared and primed or galvanized as specified before delivery to the site.

Store all on- or off-site materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting. Maintain protective covering on materials until installation is complete.

Keep on-site handling to a minimum.

#### Project Conditions

The complete coating system shall be applied in an enclosed shop except for field touch-up painting which shall be applied after rail items have been installed in accordance with the requirements of the various Sections of this Specification. The enclosed shop shall be a permanent facility with outside walls to grade and a roof where surface preparation and coating activities are normally conducted in an environment not subject to outdoor weather conditions and/or blowing dust.

1. Indoor temperature: Maintain indoor temperature at 65 degrees Fahrenheit during application and drying of paints.
2. Lighting: Since lighting conditions can alter appearances of finish painting work, perform work of this Section under lighting conditions simulating permanent lighting system to the greatest extent possible.

#### Field Touch Up:

1. Outdoor Temperature and Conditions: Air and surface temperature shall be between 50 degrees Fahrenheit and 90 degrees Fahrenheit. Surfaces shall be dry within limits of finish system manufacturer.
2. Do not paint exterior surfaces while surfaces are exposed to the hot sun.

### Quality Assurance

**Qualification of Workers:** Use only skilled iron workers, founders and welders who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the ironwork. Welders shall be AWS certified and such certification shall be furnished to the Engineer for each welder used.

The same coating material manufacturer shall furnish all materials for the complete coating system. Intermixing of materials within and between coating systems will not be permitted. Thinning of paint shall conform to the manufacturer's written instructions

Where manufacturer makes more than one grade of any material specified, use the highest grade of each type, whether or not the material is mentioned by trade name in this Section.

Include on labels of all containers the manufacturer's name, the product name and number, the color and batch number.

All welding must be inspected by the Contractor. An AWS-Certified Welding Inspector must inspect all shop welds upon completion of fabrication and prior to application of coating system. An AWS-Certified Welding Inspector must inspect all field welds upon completion of rail install.

### Materials

All rail work shall be free from defects impairing strength, durability or appearance and shall be of the best commercial quality for each intended purpose. All fabricated metals shall be furnished and custom fabricated from new materials. Materials for items which will be exposed to view shall be free from surface blemishes, pitting, blow holes, warpage, rolled trade names, roughness, burrs, fins and gates, and tool marks. Retain neat parting lines on castings unless specifically called for removal elsewhere in these Documents. Provide all supplemental parts necessary to complete each metal fabrication work item whether or not such parts are shown and specified. Provide all anchorage for securing the work required in this Section, unless otherwise noted. Provide fastenings of the same color and paint finish as the metal fabrication which it attaches unless otherwise indicated in the Drawings or this Section. All attachments shall be concealed or tamper-proof. All connections between dissimilar metals shall be made utilizing appropriate isolation material to prevent electrolytic action leading to deterioration of materials.

### Steel

**Carbon Steel Shapes, Plate and Bar.** Comply with the requirements of ASTM A36, Standard Specifications for Structural Steel, and FS OO-S741A, Steel Plates, Shapes and Bars, Carbon, Structural.

**Mild Steel Bar Stock.** Low Carbon, general purpose, merchant quality, suitable for forming and welding, complying with AISI M-1020 and ASTM A663, Grade 65 for hot rolled flats, bars, rounds, and bar-sized shapes, and ASTM A283, Grade C, for carbon steel plates; maximum carbon content approximately 0.24%, or Engineer approved equal.

**Steel Pipe.** Black (ungalvanized) pipe conforming to ASTM A53 "Standard Specification for Pipe, Black and Hot-Dipped Zinc Coated, Welded and Seamless," and ASTM A120 "Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses." Pipe shall be of Standard Weight, Schedule 40 dimensions,

weight and test pressure.

Structural Steel Tube. Conform to ASTM A501, "Hot-Formed Welded and Seamless Carbon Steel Structural Tubing."

#### Appurtenances

Wedges, Shims and Shim Washers. Stainless steel conforming to ASTM F436 or as approved by the Engineer.

Welding Rods and Electrodes. Welding electrodes for arc welding shall conform to the latest AWS code for the type of materials being welded. Welding rods shall be of the type that optimizes the weld joint for the type of materials being welded.

Anchor Rods shall be Hilti Super HAS threaded galvanized steel rod as manufactured by Hilti, Inc., 5400 S. 122nd E. Ave., Tulsa, OK 74146, Phone: (866) 445-8827 or an approved equal.

Epoxy Adhesive shall be Hilti- HIT-RE 500 as manufactured by Hilti, Inc., 5400 S. 122nd E. Ave., Tulsa, OK 74146, phone: (866) 445-8827 or an approved equal.

Foam shall be Minimal Expanding Foam Sealant as manufactured by Insta-Foam Products, Inc., 1500 Cedarwood Dr., Joliet, IL 60435-3187, phone: (800) 800-3626, (815) 741-6800 or an approved equal.

#### Galvanizing

Galvanizing of all materials and fabrications called out on the Drawings to be galvanized shall be the hot-dip method, only.

Galvanizing of fabricated steel as indicated on Drawings to be galvanized shall be as follows:

1. Carbon Steel Fabrications and Iron Castings. ASTM A123, B-6.
2. Iron and Steel Hardware. ASTM A153.

Galvanizing Assembled Steel Fabrications. Galvanize only after all welding, cutting, and grinding fabrication and finishing work is complete. Only where items are too large for industry-standard galvanizing tanks shall galvanizing before full assembly be acceptable.

Each galvanized piece shall bear the stamp of the galvanizer indicating the ASTM specification number and the weight of the zinc coating per square foot

### Paint and Finish Products

First coat primer for shop painting and touch-up paint for field touch-up of galvanized surfaces shall be a two-component, moisture-cured, zinc-rich inorganic or organic epoxy primer, 3 mils DFT. Recommended Dry Film Thickness shall be as recommended by manufacturer and approved by Engineer. Acceptable products and their manufacturers shall include the following or approved equal:

1. Zinc Clad III HS, Organic Zinc-Rich Epoxy Primer  
Sherwin-Williams Company  
[www.sherwin-williams.com](http://www.sherwin-williams.com)
2. Tnemec, Inc.  
6800 Corporate Drive  
Kansas City, MO 64120  
(800) 863-6321
3. International Coatings  
Pittsburg Airport Bus. Park, Bldg 1 Suite 140  
181 Spring Run Rd, Coraopolis, PA 15108  
(858) 547 8810

Second coat for shop painting of galvanized surfaces shall be an epoxy mid-coating, 4 mils DFT. Recommended Dry Film Thickness shall be as recommended by manufacturer and approved by Engineer. Acceptable products and their manufacturers shall include the following or approved equal:

1. Recoatable Epoxy Primer  
Sherwin-Williams Company  
[www.sherwin-williams.com](http://www.sherwin-williams.com)
2. Tnemec, Inc.  
6800 Corporate Drive  
Kansas City, MO 64120  
(800) 863-6321
3. International Coatings  
Pittsburg Airport Bus. Park, Bldg 1 Suite 140  
181 Spring Run Rd, Coraopolis, PA 15108  
(858) 547 8810

Third and fourth coats for shop painting of galvanized surfaces shall be an aliphatic urethane coating, 4 mils DFT. Recommended Dry Film Thickness shall be as recommended by manufacturer and approved by Engineer. Acceptable products and their manufacturers shall include the following or approved equal:

1. Hi-Solids Polyurethane  
Sherwin-Williams Company  
[www.sherwin-williams.com](http://www.sherwin-williams.com)
2. Tnemec, Inc.  
6800 Corporate Drive  
Kansas City, MO 64120  
(800) 863-6321
3. International Coatings  
Pittsburg Airport Bus. Park, Bldg 1 Suite 140  
181 Spring Run Rd, Coraopolis, PA 15108  
(858) 547 8810



Surface Preparation: Coat over preceding epoxy or urethane coat within 24 hours

Color shall be black.

#### Miscellaneous Materials

Use only high quality, non-shrink materials for filling compounds which have been approved.

Grout as required for anchoring shall be a pourable, quick setting, non-metallic and non-shrinking hydraulic cement grout. Acceptable products and their manufacturers shall include the following or approved equal:

1. Five Star Grout  
U.S. Grout Corporation  
425 Stillson Road  
Fairfield, CT 06430  
(800) 243-2206
2. Sika Grout 212  
Sika Corporation  
Lyndhurst, NJ 07071  
(201) 933-8800
3. Harris Construction Grout  
AH Harris & Sons  
10 West Mill St.  
Medfield, MA 02052  
(508) 359-7321

#### Hardware

ASTM A276-95, Type 304 stainless steel bolts, nuts and washers. Dimensions shown on Drawings.

#### Construction Methods

Coordinate fabrication schedule with construction progress as required by Contractor to avoid delay of work. Inspect all work areas at the Project Site to assure that proper conditions exist to receive delivery of rail items fabricated under this Section. Notify the Engineer in writing before delivery should any condition exist that requires correction. Failure to make such a report shall be construed as acceptance of the existing conditions at the Project Site and the responsibility for delays of Work and damage to rail items.

The new rail shall be protected from contamination, damage and moisture after being delivered to the site. Rail shall not be in contact with the ground. Protect finished surfaces and prevent distortion damage or contamination during handling and installation.

Work Exposed to View: For work exposed to view, select materials with special care. Provide materials which are smooth and free of blemishes such as pits, roller marks, trade names, scale and roughness. Fabricate work with uniform hairline joints. Form welded joints and seams continuously. Grind welds flush to be smooth after painting. For exposed fasteners, use hex head bolts or Phillips head machine screws. Exposed fasteners shall be vandal-proof.

Metal fabricator shall provide all steel anchor rod and plate assemblies including proposed layout drawings to the general contractor for proper layout of anchor rod assembly. Following wall casting, the metal fabricator shall provide as-built layout drawings of installed anchor rod assemblies for use during shop fabrication.

### Fabrication

Newly fabricated work shall be shop assembled in sections or entirely so far as practicable, except as indicated the Drawings, and accurately finished with any separate sections match-marked for coordinated field erection. Where necessary, measurements shall be made of prior installed construction before fabrication of the items so that work included shall properly fit the construction.

All work shall conform to details indicated on the Drawings, be clean and straight with sharply defined profiles. Unless otherwise noted, finish surfaces shall be smooth.

Castings shall be carefully made, straight, true to mold, with smooth surfaces, clean-cut sharp arises with intersections well defined, free from blowholes, shrinkage defects, cracks or other injurious defects.

Curved work shall be formed to smoothly bent true radii. Elbow joints shall be uniformly mitered with equal angles, free from twists.

Shearing, cutting, drilling, and punching shall be done cleanly so as not to deform or mar adjacent surfaces. Remove burrs from all exposed cut edges.

Shop connections shall be arc-welded and field connections shall be prepared for bolting unless otherwise indicated on Drawings.

Dimensions of new materials and details of assembly and support shall be provided as indicated on Drawings or as otherwise required to provide ample strength and stiffness.

Provide holes and connections as required on the Drawings to accommodate the work of other trades for site assembly of rail work. Holes shall be drilled or punched only and, as required, tapped or reamed in the shop. Show sizes and locations of all such machining on the Shop Drawings.

Joints and connections exposed to weather shall be formed or otherwise made to exclude water.

**Welding, Cutting and Grinding**

Welding shall be performed according to procedures, processes, details, and joint forms prescribed in AWS D1.0, "Code for Welding in Building Construction."

Welders shall be prequalified as prescribed in AWS D1.0, "Code for Welding in Building Construction." Evidence of such prequalification shall be furnished to the Engineer upon request.

No testing of welds by the Contractor is required if those used are prequalified under AWS D1.1, "Structural Welding Code." If other than prequalified joint forms are used, testing of same shall be provided by the Contractor at no increase in the contract price by a certified welding inspector chosen and paid by the Contractor as approved by the Engineer.

Thoroughly fuse all welds without undercutting or overlap. Discoloration of surfaces is not acceptable. Welds shall be continuous along line of joint unless indicated otherwise on Drawings. Spot welding is permitted for temporary welding only.

Remove welding spatter and slag from work and grind exposed welds smooth and flush to blend and contour surfaces to match or transition into those adjacent.

Perform cutting with acetylene torch, saw or pipe cutter to avoid damage to adjacent finished material. Grind smooth all cut surfaces.

**Surface Preparation of Galvanized Items**

Galvanized surfaces of miscellaneous metal items shall be inspected by the painting Contractor prior to the start of the work of this Section. Any defects in the galvanized surfaces such as lumps, sags, or spikes that would make the item not smooth to human touch, exposed bare steel not prime painted by the galvanizer with an approved paint from the same manufacturer of paint coatings approved under this Section, or prime paint not compatible with approved paint coatings shall be reported to the Engineer immediately by telephone followed by a hard copy letter addressed to the Engineer describing the defects. Do not start work of this Section, if any defects are detected. The commencement of work by the painting Contractor shall indicate his acceptance of the galvanized surfaces of the miscellaneous metals items, and he shall assume full responsibility for the work of this Section.

Prior to abrasive blast cleaning, all rough surfaces shall be ground smooth. All galvanized surfaces shall then be solvent cleaned in accordance with SSPC-SP1 - "Solvent Cleaning" before being blast cleaned.

Abrasive blast cleaning shall be performed in accordance with SSPC-SP7, "Brush-off Blast Cleaning" using a production line shot and grit blast machine or by air blast. The abrasive working mix shall be maintained such that the final surface profile is within the range specified in this Section.

All compressed air sources shall have properly sized and designed oil and moisture separators, attached and functional, to allow air at the nozzle, either for blast cleaning, blow-off, painting or breathing, to be oil-free, and moisture-free. They shall have sufficient pressure to accomplish the associated work efficiently and effectively.

No surface preparation or coating shall be done when the relative humidity is at or above 80 percent or when the surface temperature of the steel is less than 5 degrees Fahrenheit above the dewpoint temperature as determined by a surface thermometer and an electric or sling psychrometer.

Surface Profile: The galvanized surface profile shall be 1 to 3 mils.

#### Application of Paint and Finishes to Metal Surfaces

All coatings shall be applied in the shop except for field touch-up after installation. See requirements for field touch-up as described in this Section. All surface preparation and coating work, including field touch up work, shall be as specified and performed under the work of this Section.

All galvanized steel surfaces shall receive the 4-coat shop applied paint system as specified in this Section, except the following particular locations that shall be masked off and treated as follows:

1. Faying surfaces of slip-critical bolted connections shall receive only a single application of primer. The dry film thickness shall be no greater than the thickness tested on the coating manufacturer's Certified Test Report for slip coefficient.
2. Miscellaneous metal surfaces within 4 inches of field welds shall receive only a single coating of primer at 0.5 - 1.5 mils dry film thickness.
3. Galvanized steel surfaces to be in contact with grout shall not be coated.
4. Edges and shop welds of galvanized steel items shall be locally hand-striped with a brush in the longitudinal direction with an additional coat of the epoxy or urethane coating prior to application of the finish aliphatic urethane coating. The coating manufacturer shall be consulted to determine the appropriate epoxy or urethane coating to use for striping. The application of the striping materials shall be in accordance with the coatings manufacturer's written instructions. The striping material shall be tinted to distinguish it from the intermediate coats.

Application Methods: The coating system shall be applied by spray equipment of a type and size capable of applying each coat within the required thickness range. The applicator shall strictly adhere to the manufacturer's recommendations about application methods, cure times, temperature and humidity restrictions and recoat times for each individual coat of the specified system. Brushes shall be used in areas where spray application will not achieve acceptable results. Brushing technique shall be performed in a manner that will provide a uniform, blended finish. No coating material shall be thinned in any way except as required by manufacturer.

1. Conventional spray equipment with mechanical agitators shall be used for prime coat application on bare steel and for epoxy or urethane intermediate coat on galvanized surfaces.
2. All storage, mixing, thinning, application and curing efforts, techniques and methods shall be accomplished in strict accordance with the printed material data sheets and application instructions published by the respective coating material manufacturer.

3. Surfaces shall be painted with the specified prime coat material before the end of the same work shift that they were blast cleaned and before any visible rust back occurs.
4. Applied coatings shall not have runs, sags, holidays, pinholes or discontinuities.
5. The dry film thickness shall be within the range specified in the manufacturer's printed literature for the specified coating system. Dry film thickness shall be measured in accordance with SSPC-PA 2.
6. The intermediate coat shall be of a contrasting color to the prime and two topcoat colors.
7. There shall be no color variation in the topcoat as determined by comparison with Federal Standard 595B.

All storage, mixing, thinning, application and curing efforts, techniques and methods shall be accomplished in strict accordance with the written requirements and procedures published by the respective coating material manufacturer.

**Additional coats:** Provide additional coats necessary to eliminate show through and bleed through conditions.

**Drying Time:** Allow manufacturer's recommended drying time between successive coats. However, allow each coat to thoroughly dry prior to application of subsequent coat.

All compressed air sources shall be properly sized and designed with oil and moisture separators, attached and functional, to allow air at the nozzle, either for blast cleaning, blow-off, painting or breathing, to be oil-free and moisture-free. It shall be of sufficient pressure to accomplish the associated work efficiently and effectively.

Surfaces not in contact with other steel surfaces but inaccessible after assembly shall be coated prior to assembly.

Critical attention shall be given to edges and bolted connections. All bolts, nuts and washers shall be fully coated and no gaps left unfilled and un-coated.

Adhesion strength of the fully coated assemblies shall be within 80 percent of the values for Adhesion as described in the approved manufacturer's literature measured per ASTM D4541 using apparatus under Annex A4.

Strict attention must be directed to the re-coat times of all applied materials. Shop bolted connections shall also have all bolt heads and nuts striped in a circular brush motion with the same material.

All applied coating shall have no runs, sags, holidays or discontinuities; the dry film thickness shall be within the range specified. There shall be no color variation in the topcoat as determined by Federal Standard 595B. Also, there shall be no gloss variation in the topcoat where tested in accordance with ASTM D523.

**Protection of Coated Miscellaneous Metal:** All fully coated and cured assemblies shall be protected from handling and shipping damage with the prudent use of padded slings, dunnage, separators and tie downs. Loading procedures and sequences shall be designed to protect all coated surfaces.

#### Field Touch Up

Touch-up and repair finishes that, for any reason, have been damaged during construction work.

Field application of coatings shall be in accordance with the manufacturer's written application guidelines and these specifications. All areas cleaned to bare metal must be coated with a zinc-rich primer before any visible rust back occurs. The topcoat material for field touch-up painting and additional field topcoat application shall be from the same lot and batch used in the shop provided its shelf life has not expired. If the shelf life has expired, the same material of the same color from a different lot and batch shall be used. The materials used for the field primer and intermediate coat must be compatible with the shop primer and intermediate coats.

All rust, scale, dirt, grease, concrete splatter and other foreign material on connections, bolts, nuts and around field welds shall be completely removed by power tool cleaning per SSPC-SP 11. Areas cleaned to SSPC-SP 11 shall have a 1-3 mil profile and must be primed prior to rusting. All debris generated from cleaning operations must be contained and properly disposed of.

Bolts, nuts and washers shall receive brush applications of intermediate and topcoat after final tensioning. Careful attention shall be given to bolted connections to insure that all bolts, nuts and washers are fully coated and that no gaps are left unfilled and uncoated.

Field welded areas shall be treated in the same manner as shop welded areas, including special treatment requirements.

At damaged areas that extend back to the steel surface (such as scratches, gouges or nicks), the entire three-coat system shall be locally reapplied after power tool cleaning to bare metal in accordance with SSPC-SP 11. The coating system adjacent to the damage shall be feathered back to increase the surface area for touch up painting. The area cleaned to SSPC-SP 11 shall be primed with a zinc-rich primer before rustback occurs. The coating manufacturer shall be consulted to determine the appropriate zinc-rich primer to use. Application of the zinc-rich primer shall be in accordance with the coating manufacturers written instructions. The specified intermediate and topcoats shall be reapplied in accordance with the manufacturer's written instructions.

At damaged areas that extend back only to the prime or intermediate coat, the area shall have the topcoat applied. Application of the touch-up materials in these damaged areas shall be performed by brush only.

Tarps shall be used to collect all surface preparation debris. The Contractor shall be responsible for disposing of all removed materials, including tarps.

#### Acceptance Standards

Finished work shall be free from runs, sags, hairs, defective brushing, and clogging of lines and angles. Flaws visible in the completed work shall be removed and the area satisfactorily repaired.

Completed Work: Provide finishes that match approved samples and mock-ups for color, texture, and coverage, remove, refinish, or repaint work not in compliance with the requirements of this section.

#### Completion of Painting of Rails

Cleaning: At completion of work of this Section, remove paint and finish spots, and oil, grease, and other stains caused by this work from exposed vertical and horizontal surfaces. Leave finished work in a satisfactory condition.

At completion of work of this Section, remove masking materials and other debris. Reinstall or replace fixtures, plates, etc., removed to facilitate application of paint.

Final Inspection: Protect painted surfaces against damage until date of Substantial Completion. Engineer will conduct final inspection of painting work. Areas that do not comply with requirements of these Specifications shall be repainted or retouched to satisfaction of Engineer at no additional cost to Department.

#### Installation of Rails

Lay out work at site as indicated on the Drawings and approved layout drawings. Check measurements, compare dimensions and other data with various trades installing adjoining work to assure coordination.

Construct and erect all work square, plumb, and straight and true to line and level or grade. Work shall be accurately fitted with tight joints and intersections, properly fitted, welded or bolted together, and adequately anchored in place.

Do not install any work for which layout does not conform to dimensions or layout instructions given on the Drawings or does not check in or reconcile with layout of other work. Request clarification in writing from Engineer before proceeding with the layout.

Anchor plate and corresponding baseplate attachment locations that shall receive new rail posts along the concrete wall shall be as indicated on the Contract Drawings and verified in the field prior to shop drawing submittals. Core drilling and percussive drilling for rail post sockets is not permitted.

All steel anchor rod and plate assemblies shall be cast into restored wall cap with templates supplied by the metal fabricator for use during concrete wall formwork.

Grouting Preparation. Make cored holes clean and free of standing water with compressed air jet before setting stanchions or posts. Compressor must be fitted with oil trap on air line to prevent oil being injected into the hole and affecting the bonding of the grout. Cored post sockets in concrete shall be prewetted by being filled with water during the 24 hours preceding grout placement. Center, plumb and align stanchion or post in socket to required top elevation, and provide stable temporary wedging of stanchion into upper part of socket.

Grout Mixing. Mix grout only as recommended by the manufacturer's printed instructions with only the amount of water required to achieve the consistency specified. Do not add aggregate of any kind to the grout.

Grout Placement. Place grout only as recommended by the manufacturer's printed instructions. Pour annular grout column so as not to introduce air pockets into the grout. Fill void to bottom of temporary wedging with grout in one pour, bringing grout completely to the top of the socket in a second pour after initial set and wedge removal.

Clean Up. Completely remove any grout deposited anywhere except in the stanchion sockets.

#### Repair of Damaged Installed Work

Repair minor damage to eliminate all evidence of damage repair. Remove and replace work which cannot be satisfactorily repaired as determined by the Engineer.

**Touch-up painting procedures of rail items require prior acceptance by the Engineer.** Prepare for painting and prime areas of damaged coatings and finishes with specified primer immediately upon completion of repair to prevent oxidation.

#### COMPENSATION

Railings will be measured for payment by the foot, complete in place.

Railings will be paid for at the Contract unit price per foot, which price shall include all material, labor, materials, equipment and incidental costs required to complete the work.

#### ITEM 665.3

#### 72 INCH STOCKADE FENCE

#### FOOT

The work under this item shall conform to the relevant provisions of Section 600 of the Standard Specifications and the following:

Work under this item shall consist of installing prefabricated wooden stockade fence at locations shown on the plans and/or as directed by the Engineer. Fence construction and installation shall conform to the installation procedure shown on the construction details. The work shall include all materials, labor and equipment necessary to complete the construction and erection of the Cedar Stockade Fence.

The Contractor shall be responsible for field measurements and location of wood fencing. Layout drawing(s) indicating post locations and section lengths shall be submitted to the Engineer for review and approval, prior to fabrication.

The Contractor shall submit shop drawings and/or catalog cuts including details illustrating fence height, sizes of posts, rails, sections and all appurtenances for approval, prior to fence fabrication.

#### MATERIAL

Wood fence posts shall be Number 2 Pine Pressure Treated Lumber, or other approved species. Wood Pickets and rails to be Number 1 Cedar. Wood shall be marked to indicate the wood grade and preservative standard. All hardware shall be stainless steel or galvanized. Posts shall be ACQ treated and have a preservative retention level of 0.40 or an MCA of 0.16 pcf.



Fencing shall be 6 feet in height, selected for strength and decay resistance in its intended use. All wood shall be debarked. Wood members shall be sized for the sufficient strength.

Nail screws shall be high quality grade, of the type commonly used for its intended purpose. Nail screws shall be sized for long-life holding power and to prevent splitting wood members.

Fencing shall be produced by a manufacturer normally producing wood fence products of this type.

### CONSTRUCTION

Posts and fence elements shall be set plumb in excavated holes backfilled with gravel unless otherwise directed by the Engineer.

All wood members should be evenly sized within range of approximate limits, uniform and straight. Post tops shall be shaped into blunt curved end. A prefabricated picket/stockade fence system is required. Backing rails shall be shaped to provide flattened surface for picket attachment. Picket tops shall be curved points. Members shall be installed to form a sturdy, stockade-type visual screen.

The lines of the fence shall follow the fence lines as indicated on the drawings. Tops and bottoms shall be installed straight and level, stepped to any grade. All sections shall be plumb and straight.

Posts and pickets shall be installed plumb and parallel to each other. Rails shall be installed perpendicular to posts and evenly spaced.

Fence posts shall be evenly spaced approximately 8 feet on center and buried to a minimum depth of 3'-6", and as necessary to accommodate any changes in grade. Earth shall be properly compacted around posts for firm support. If unsuitable soil conditions occur such as rock, ledge and peat, notify the Engineer for acceptable alternate post setting customary in the trade.

### COMPENSATION

72 inch stockade fence will be measured for payment by the foot along the top rail from center to center of end posts, complete in place.

72 inch stockade fence will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment, and incidental costs required to complete the work.

No separate payment will be made for line posts, end posts, bracing, gravel borrow for post foundations, concrete footing if required and hardware, but all costs in connection therewith shall be included in the Contract unit price bid.

**ITEM 673.****STEEL PIPE ACCESS GATE****EACH****DESCRIPTION**

Work under this item shall consist of installing steel pipe access gates and locking posts as shown on the plans and where directed by the Engineer.

**MATERIALS**

Steel pipe for straight sections shall be Schedule 40 circular seamless steel pipe in accordance with ASTM 53 Type F. Steel pipe for all sections formed with bends or curves shall be schedule 40, circular seamless steel pipe in accordance with ASTM A53 Grade B Type E.

All hardware shall conform to ASTM A307 requirements and shall be galvanized per ASTM A153.

All steel to be painted shall be galvanized in accordance with relevant sections of ASTM A123 or ASTM A386 to assure proper bonding of paint to steel surfaces exposed to the weather.

The contractor shall submit shop drawings to the Engineer for approval. After approval by the Engineer, fabrication of the gates may proceed.

All castings shall be true to drawings. They shall have a dense smooth surface, uniform quality of appearance, free from blow holes or runoffs, porous spots, hard spots and shrinkage faults and cracks.

All castings shall be thoroughly and carefully cleared of all sand, scale and fins. They shall be free from marks of core anchors, projections and imperfections.

The Contractor shall furnish all supplemental parts necessary to complete each item whether or not such parts are shown or specified. Fastenings shall be of the same material, color and finish as the metal to which applied unless otherwise indicated.

Paint shall conform to current standards and be subject to the approval of the Engineer. Color is black.

**CONSTRUCTION**

1. Metal Workmanship: Work shall be executed only by mechanics experienced in the trade.

Welding shall be done by certified welders only. Welding shall be in conformance with AWS codes. The Contractor shall obtain the exact dimensions at the site and will be held responsible for the accurate erection of all parts of this work. The Contractor shall check measurements, compare dimensions and other data with various trades installing adjoining work to assure proper coordination.

Cut, fit and drill as necessary for proper assembly and installation of all work for attaching items of other trades prior to galvanizing. Contractor shall not alter the galvanized fabrication in the field without Engineer's approval.

All joints exposed to the weather shall be formed to exclude water. All connections shall be formed with "fish-mouthed" joints full seam welded, ground smooth and sanded and shall present an appearance of a complete homogeneous metal.

Shop connections shall be welded and field connections bolted unless otherwise indicated. Bolts shall be turned up tight and threads deformed to prevent loosening. Draw up all threaded connections tightly, after buttering the same with pipe joint compound, to exclude water.

2. Metal Fabrication: Shop fabrication shall be welded. Steel shall be well-formed to shape and sized for shape lines or angles. Shearing and punching shall leave clean, true lines and surfaces.

Arc welding procedures shall conform to the current standards of the AWS. All welds shall be ground smooth and flush to a neat finish. Ease all corners. Metal shall not be primed, galvanized, or painted before welding.

Castings shall be sound and free from warp, holes and other defects that impair their strength and appearance. Exposed surfaces shall have a smooth finish with sharp, well-defined lines and arises.

Machine joints, where required, shall be milled to a close fit. Thickness of metal and details of assembly shall give ample strength and stiffness.

3. Hot-Dip Galvanizing: All exterior ferrous metal mentioned under Metal Fabrication and Metal Workmanship above shall be hot-dip galvanized.

Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing and/or shop priming.

Galvanizing shall be in a dry kettle process in accordance with ASTM A 123, ASTM A 153 and ASTM A385, as applicable. Galvanizing shall be done with a nickel enrichment of the galvanizing tank. Galvanizer shall provide notarized certification that the galvanizing process used was done in accordance with these specifications and has the nickel enrichment. It shall state day each piece was galvanized.

Prior to galvanizing, all metal shall be cleaned (pickled) in accordance with SSPC-SP8. Cleaning shall remove all rust, scale, and coating surface must be clean, dry, undamaged and free of all loose rust, dirt, grease, or other contaminants including salt deposits.

Galvanize all ferrous fasteners, clips, sleeves, anchors and accessories in contact with galvanized items.

All galvanized materials shall be marked with a stamp indicating the name of the galvanizer, the ASTM Specification and the weight of the zinc coating in ounces per square foot.

Items to be galvanized shall be galvanized after fabrication. Where size of assembly is too large for complete unit galvanizing, these assemblies shall be galvanized prior to fabrication, in as large sections as practical and then only with the written approval of the Engineer.

Touch-Up and Repair: For damaged and field welded metal-coated surfaces, clean welds, bolted connections and abraded areas. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A780. Galvanizing repair paint shall have 65 percent zinc by weight. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A123 or A153 as applicable.

4. Surface Treatment: Metal finishes of the steel pipe gates shall be painted. Color is black.
5. Attachment: Steel pipe gates shall be anchored into the concrete base as shown in the details on the drawings.

Install steel pipe gates level and plumb at locations indicated on the plans in accordance with approved shop drawings. Coordinate sequence of operation in planning footings and installation of surrounding pavement.

The Contractor shall be responsible for scheduling the delivery of all items so as to minimize on-site storage time prior to installation. All stored materials and items shall be protected from weather, careless handling and vandalism.

Protect steel pipe gates from paint spatter, concrete splashes and other construction damage by wrapping in plastic sheeting or heavy kraft paper and taping in place. Do not remove until adjacent work is completed. Repair any damage to painted finish.

### COMPENSATION

Steel pipe gate will be measured as one unit each, complete in place.

Steel pipe gate will be paid for at the Contract unit price bid each unit installed, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for hardware, concrete, close and open position gate posts and heavy duty locking chain, but all costs in connection therewith shall be included in the Contract unit price bid.

**ITEM 690.2****GRANITE HEADWALL REMOVED  
AND REBUILT IN CEMENT MORTAR****EACH**

The work under this Item shall conform to the applicable provisions of Sections 151, 685, 690, 901, of the Standard Specifications, the Plans, and the following:

The work under this heading consists of removing, cleaning, storing, and resetting the granite headwall stones of the existing granite slab bridges as noted on the plans. All removal, disposal and replacement of the soil behind and around the headwall required to access and re-set the headwall shall be considered incidental to this item. Removal of vegetation required to access the headwall shall also be considered incidental to this item.

**MATERIALS**

Cement for setting shall be standard Portland Cement. Sand shall conform to the requirements of MassDOT Standard Specifications Subsection M4.02.15 Cement Mortar. Water shall conform to the requirements of MassDOT Standard Specifications Subsection M4.02.04 High-early-strength cement shall not be used. Mortar for setting shall consist of one part cement, two parts sand, and water. The cement and sand shall be thoroughly mixed dry and the water shall then be added to make a putty-like consistency. The mortar shall be prepared only in such quantities as can be used before initial set takes place. The use of retempered mortar is not permitted.

**CONSTRUCTION METHODS**

The granite work shall be completed by masons who, in the opinion of the Engineer, are experienced in this class of work.

Each granite block shall be thoroughly cleaned after removal. The Contractor shall take care not to damage the existing granite slab bridge stones during the disassembly and reconstruction of the headwall. The Contractor shall prevent damage to existing granite headwall which is to be retained undisturbed. If damaged, the granite headwall stone, or bridge slab stone shall be replaced with a new slab, matching the dimensions of the existing slab prior to the damage having occurred. The additional material and work associated with replacing the granite slab shall be at the Contractor's expense.

During reconstruction, each granite block shall be laid in a full mortar bed. Prior to setting, all joints are to be raked to a 1" depth. A block shall not be permitted to slide on the mortar bed while it is being set. Beds shall be horizontal. The bed shall be 1 inch  $\pm$  ¼ inch. The face and sides of the stone shall be kept free from mortar. The granite shall be thoroughly cleaned after setting, and pointed using a 1 inch flat head point. The use of wire brushes, acids, or solutions that might discolor the granite are prohibited.

After the mortar has been allowed to set for a minimum of 3 days, the soil behind and adjacent to the headwall can be placed. The soil is to conform to the requirements of Item 151.2 Gravel Borrow for Backfilling Structures and Pipes. The soil placed behind the headwall is considered incidental to this item.

## COMPENSATION

The work under this Item shall be measured and paid for at the Contract unit price per each headwall for Item 690.2 – Granite Headwall Removed and Rebuilt in Cement Mortar complete and to the satisfaction of the Engineer. The cost for this work shall include full compensation for, including, but not limited to, all labor, equipment, worker protection, environmental compliance, materials, tools, material testing, removal of vegetation and soil required for access, cleaning and prewetting the masonry, finishing work to masonry, replacing the soil, and any incidentals required to complete the work to the satisfaction of the Engineer in accordance with all requirements of the contract. The Contractor will be paid for the total number of headwalls removed and replaced, as shown on the drawings or directed by the engineer.

### ITEM 690.3

### GRANITE SLAB CULVERT REMOVED AND REBUILT IN CEMENT MORTAR

### LUMP SUM

The work under this Item shall conform to the applicable provisions of Sections 151, 504, 685, 690, 901, of the Standard Specifications, the Plans, and the following:

The work under this heading consists of removing, cleaning, storing, and resetting the granite slabs of the culvert located at station 244+51 and as noted on the plans. All removal, disposal and replacement of the soil over the granite slab culvert and as required for resetting of the slabs is incidental to this item. Removal of vegetation required to access the culvert shall also be considered incidental to this item. The visible damage is to the exposed ends of the culvert, but the contractor is responsible to determine the full extent of the damage prior to bidding. No additional compensation will be given for repairs over the entire length of the culvert.

Granite slabs that are cracked shall be replaced with new granite slabs. Replacement is considered incidental to this item. All new granite shall be free of cracks or fissures. Any slab with a transverse crack requires replacement. Any longitudinal crack that results in pieces of granite being thinner than 12" wide shall require replacement of all pieces less than 12" wide. Disposal of any unsuitable granite slabs shall be considered incidental to this item.

The slabs are to be set level on the existing abutments. Any modifications to the existing abutments required to set the slabs level is considered incidental to this item.

## MATERIALS

Cement for setting shall be standard Portland Cement. Sand shall conform to the requirements of MassDOT Standard Specifications Subsection M4.02.15 Cement Mortar. Water shall conform to the requirements of MassDOT Standard Specifications Subsection M4.02.04 High-early-strength cement shall not be used. Mortar for setting shall consist of one part cement, two parts sand, and water. The cement and sand shall be thoroughly mixed dry and the water shall then be added to make a putty-like consistency. The mortar shall be prepared only in such quantities as can be used before initial set takes place. The use of retempered mortar is not permitted.

The minimum width of a granite slab is to be 12". Thickness of all slabs is to match existing. The length and thickness of the slabs shall be the same dimensions plus or minus 1" of the slab being replaced. All granite shall conform to M9.04.9 Dry Stone Masonry and the requirements of this special provision.

### CONSTRUCTION METHODS

The granite work shall be completed by masons who, in the opinion of the Engineer, are experienced in this class of work.

Each granite block shall be thoroughly cleaned after removal. The Contractor shall take care not to damage the existing granite slab bridge stones that do not need to be removed and reset, during the disassembly and reconstruction of the parapet. The Contractor shall prevent damage to existing granite headwall which is to be reset under Item 690.2. If damaged, the stone shall be replaced with a new stone, matching the dimensions of the existing stone prior to the damage having occurred. The additional material and work associated with replacing the granite shall be at the Contractor's expense.

During reconstruction, each granite block shall be laid in full mortar beds with full mortar joints. Prior to setting, all joints are to be raked to a 1" depth. A block shall not be permitted to slide on the mortar bed while it is being set. Beds shall be horizontal and all joints shall be plumb. Beds and joints shall be 1 inch  $\pm$  ¼ inch. The face of stone shall be kept free from mortar. Granite block work shall be thoroughly cleaned after setting, and pointed using a 1 inch flat head point. The use of wire brushes, acids, or solutions that might discolor the granite are prohibited.

The bridge and headwall slabs to be removed and reset shall be carefully removed by the Contractor and stored at a safe location. Slabs to be removed and reset shall be examined for their structural integrity. Any slabs broken or damaged by the Contractor's operations shall be replaced at no additional cost to the Department.

After the mortar has been allowed to set for a minimum of 3 days, the soil over the slabs can be replaced. The soil is to conform to the requirements of Item 151.2 Gravel Borrow for Backfilling Structures and Pipes. The soil placed behind the headwall is considered incidental to this item.

### COMPENSATION

The work under this Item shall be measured and paid for at the Contract unit price per each headwall for Item 690.3 – Granite Slab Culvert Removed and Rebuilt in Cement Mortar complete and to the satisfaction of the Engineer. The cost for this work shall include full compensation for, including, but not limited to, all labor, equipment, worker protection, environmental compliance, materials, tools, material testing, removal of vegetation and soil required for access, cleaning and prewetting the masonry, finishing work to masonry, replacing the soil, and any incidentals required to complete the work to the satisfaction of the Engineer in accordance with all requirements of the contract. The Contractor will be paid for the lump sum of repairs to the culvert at station 244+51 or directed by the engineer.

**ITEM 691.01****LANDSCAPE BOULDER****EACH****DESCRIPTION**

The work shall consist of furnishing and placement of individual boulders to provide physical barriers. Locate and install boulders as shown on the plans and as directed by the Engineer. Boulders shall be placed to prevent all terrain vehicles from gaining access to the trail. Boulders shall be placed with the “best side” up, 4 feet apart. A base 6 inches thick of crushed stone shall be placed under each stone.

**MATERIALS**

Landscape boulder shall be clean, solid, durable stone boulders that can easily be placed as directed. The boulder shall have an approximate minimum width, length and height of 3 feet and a maximum width, length and height of 5 feet. The ratio between the smallest and largest dimension shall not exceed 1.5. The boulder shall also be as near to round or cubical dimensions as practical and reasonable to be accepted as suitable. No flat or elongated boulders will be accepted. The top of the boulders shall be in reasonable horizontal and vertical alignment to provide a pleasing appearance when used with other boulders in the construction of a barrier. The Contractor shall submit details and photos of the proposed boulders for approval. Crushed stone shall conform to the relevant provisions of Section 402 of the Standard Specification.

**CONSTRUCTION**

Landscape boulders shall be placed at the location shown on the plans and as directed by the Engineer. Boulders shall be placed to create a smooth and uniform barrier in every direction.

The ground beneath the rock boulder shall be excavated to specified depth to accept crushed stone. Stone shall be graded or shaped to receive the boulder so as to prevent any rocking or movement of the boulder.

**COMPENSATION**

Landscape boulders will be measured for payment by each boulder placed, complete in place.

Landscape boulders will be paid for at the Contract price each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for transportation, excavation and crushed stone, but all costs in connection therewith shall be included in the Contract unit price bid.



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<b><u>ITEM 691.1</u></b>	<b><u>LANDSCAPE BOULDER REMOVED AND RESET</u></b>	<b><u>EACH</u></b>
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**DESCRIPTION**

The Contractor shall remove existing rock boulders from various locations along the proposed bike path and relocate them to the locations as shown on the plans.

**CONSTRUCTION**

Landscape boulders shall be placed at the location shown on the plans and as directed by the Engineer. Boulders shall be placed to create a smooth and uniform barrier in every direction.

The ground beneath the rock boulder shall be excavated to a depth of 6 inches accept crushed stone. Stone shall be graded or shaped to receive the boulder so as to prevent any rocking or movement of the boulder. Crushed stone shall conform to the relevant provisions of Section 402 of the Standard Specification.

**COMPENSATION**

Boulders removed and reset will be measured for payment by the each complete and in place.

Boulder removed and reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for transportation, excavation and crushed stone, but all costs in connection therewith shall be included in the Contract unit price bid.

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<b><u>ITEM 699.</u></b>	<b><u>FILTER STRIP</u></b>	<b><u>SQUARE YARD</u></b>
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The work under this item shall conform to the relevant provisions of Section 765 of the Standard Specifications and the following:

**DESCRIPTION**

The work shall include the construction of the Filter Strips where shown on the plans or as directed by the Engineer.

**MATERIALS**

Two (2) inches of stable and mature compost shall be provided for the entire Filter Strip Treatment Area to amend the topsoil unless the soil already has an organic content of 5% or greater. Contractor shall test existing soil to determine organic content. The compost must be mechanically tilled into the underlying native soil to a depth of 4 inches to prevent washing out the compost and avoid creating a defined layer of different soil types that could prevent downward percolation of water.

Compost shall be as specified in the Materials Section of the Standard Specification.

Compost shall not contain any sawdust, straw, green or under-composted organic matter, or toxic or otherwise harmful materials. Compost should not contain unsterilized manure.

Soil with a clay content which has more than 10% passing the no. 200 sieve shall be avoided.

The permanent erosion control grass seed mix shall be as follows unless a Horticultural or Erosion-Control Specialist recommends a different mix:

- 20% Big Bluestem
- 15% Creeping Fescue
- 10% Little Bluestem
- 10% Canada Wild Rye
- 10% Virginia Wild Rye
- 7% Switch Grass
- 7% Partridge Pea
- 7% Showy Tick Trefoil
- 7% Fringed Brome Grass
- 7% Deer Tongue

The seed mix shall be applied by hydroseeding or by hand broadcasting at a rate of 1 LB/1000 SF.

The seed shall be Pure Live Seed.

The season for seeding work shall be from April 1 to June 1 and from August 15 to October 15 with the following qualifications. The actual turf construction work shall be done only during periods within the season which are normal for such work as determined by weather conditions and by accepted practice in this locality and as accepted by the Engineer.

Level Spreader shall meet the requirements specified in the following Subsection of Division III, Materials:

Crushed Stone            M2.01.1

## CONSTRUCTION

All trees, stumps, brush, rocks and similar materials that could interfere with installation should be removed and disposed of in a manner that is consistent with standards for maintaining and improving the quality of the environment and with proper functioning of the filter strip.

Erosion control must be provided before construction begins. Filter strip must be protected during construction. If construction impacts the filter strip, the Contractor shall reconstruct the filter strip and re-establish vegetation to the satisfaction of the Engineer at no cost to the Department. Runoff must be diverted around a filter strip until the grass is established.

The filter strip shall be shaped to the grade and dimensions shown in the plans or as directed by the Engineer. If necessary, topsoil shall be stockpiled and spread to the required grade and thickness.

Excess spoil shall be disposed of in areas where it does not interfere with the required flow characteristics of the filter strip.

All areas disturbed during construction shall be vegetated.

Broadcast Seeding: Seed may be broadcast by using a cyclone or whirlwind seeder, or by hand. If spread by hand, small or light-seeded species such as bluestem may be mixed with filler (e.g., sawdust, kitty litter, or clean washed sand) to achieve an even distribution. Seed shall be applied in two directions, each perpendicular to one another. One half the seeding rate shall be applied in each direction. Seed shall be incorporated 1/8 inch to 1/4 inch deep by raking or dragging, cultipacking, or tracking with heavy machinery. Raked areas shall be rolled with a weighted roller to provide good seed to soil contact. Do not roll or track the seed if the soil is wet.

Upon completion of broadcast seeding and packing, or within 24 hours, straw mulch shall be hand broadcast uniformly over the entire planting area. Straw mulch shall be free of weed seeds and shall be applied at a uniform rate of 1517 lbs/acre. Straw mulch shall be incidental to seeding.

To aid in the establishment of vegetation, surface water runoff shall be prevented from entering the filter strip through the use of temporary diversions until after vegetation is established to a minimum height of 4 inches and 90 percent ground cover.

Irrigation shall be provided as necessary in the months following initial filter strip construction to prevent the filter strip grass from wilting or dying. If weeds grow to a height of 12", the Contractor shall mow for weed control.

A satisfactory stand of turf, as determined by the Engineer, shall be required to be acceptable. Seeded areas shall have a close stand of grass with no bare spots greater than 3 inches in diameter. At least 90 percent of the grass established shall be permanent grass species. At the time of acceptance, the Contractor shall remove temporary barriers used to protect turf areas. Absolutely no debris may be left on the site.

### COMPENSATION

Filter strip will be measured for payment by the square foot complete in place.

Filter strip will be paid for at the Contract unit price per square foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

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**ITEM 701.2                      CEMENT CONCRETE WHEELCHAIR RAMP                      SQUARE YARD**

The work under this item shall conform to the relevant provisions of Section 701 of the Standard Specifications and the following:

**DESCRIPTION**

The depth of the cement concrete wheelchair ramp shall be 4 inches in thickness.

Detectible warning panels shall be installed as shown on the Plans and as detailed in the Construction Standard Details E 107.2.0R through E 107.6.9R. The tile shall conform to the Americans with Disabilities Act (ADA) requirements. Detectable Warning Panels shall be incidental to the item. Surface mounted detectable warning panels such as thermoplastic and/or 'mats' shall not be accepted.

**COMPENSATION**

Cement concrete wheelchair ramp will be measured for payment by the square yard, complete in place.

Cement concrete wheelchair ramp will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

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**ITEM 701.3                      STAMPED CEMENT CONCRETE ISLAND                      SQUARE YARD**

The work under this item shall conform to the relevant provisions of Section 476 of the Standard Specifications and the following:

**DESCRIPTION**

Stamped cement concrete median shall consist of red colored stamped cement concrete within the splitter islands as shown on the plans. The cement concrete shall be 4 inches in thickness. A stamped brick pattern shall be utilized.

The cement concrete shall be an integrally colored cast in place concrete of a color Chromix admixture formulated by L. M. Scofield (201-672-9050), Davis Colors (800-638-4444), Butterfield Color (1-800-282-3388) or approved equivalent. The color shall be a red brick color and shall be approved by the Engineer.

Submit for review the complete technical data sheets for the colored admixture and the curing compound, the design mixes, color sample and stamped brick pattern.

The installer shall have a minimum of 5 years of experience installing colorized cast in place concrete in similar applications.

Notify the manufactures authorized representative at least 1 week prior to start of work.

Integrally colored concrete mockups shall be installed in place. The mockup shall be a minimum of 5 square yards. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards (or not less than 1/3 the capacity of the mixing drum on the ready-mix truck) and should always be in full cubic yard increments. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, stamped brick pattern and expansion joints in sample panels. Mockup shall be produced by the individual workers who will perform the remaining work. Accepted mockup provides visual standard for work. Mockup shall remain through completion of work for use as a quality standard for finished work.

Concrete materials and design shall be per manufactures recommendations. Admixture shall be added per manufactures recommendations.

Concrete mockup shall be allowed to cure for one month prior to review for color acceptance. Construct as many mockups as required by the Engineer until satisfactory colors and patterns are provided. The mockup will not be part of the finished work.

#### COMPENSATION

Stamped cement concrete median will be measured for payment by the square yard, complete in place and accepted.

Stamped cement concrete median will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

<b><u>ITEM 702.</u></b>	<b><u>HOT MIX ASPHALT WALK SURFACE</u></b>	<b><u>TON</u></b>
<b><u>ITEM 703.</u></b>	<b><u>HOT MIX ASPHALT DRIVEWAY</u></b>	<b><u>TON</u></b>

Work under these Items shall conform to the relevant provisions of Document 00717 SUPERPAVE REQUIREMENTS contained herein.

<b><u>ITEM 704.2</u></b>	<b><u>STONE DUST</u></b>	<b><u>TON</u></b>
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The work under this item shall conform to the relevant provisions of Section 150 and 701 of the Standard Specifications and the following.

The work shall include the furnishing and placing of stone dust for use on shoulders as shown on the Drawings and as directed by the Engineer. Weed barrier fabric shall be installed between the subbase and the stone dust.

#### SUBMITTALS

Prior to construction, the Contractor shall submit a sample of the stone dust and weed barrier fabric for approval by the Engineer.

During construction, the Contractor shall construct a test installation of a 50 foot length of the stone dust on both sides (100 feet total length) of a portion of the constructed trail to ensure the appropriateness of the stone dust material. The test installation shall be installed as per the plans and specifications. The test installation shall remain for approximately 30 days (a longer duration may be necessary so that a substantial rain event may be experienced) to ensure its ability to handle the potential for wash out. Once the test installation has been approved by the Engineer, the material shall be installed for the remainder of the project as called for in the contract documents. Should the test installation not provide suitable results, the gradation shall be refined as per the Engineer's direction. The test installation process shall be repeated until the proper gradation is achieved and approved by the Engineer.

## MATERIALS

Stone dust shall consist of clean, inert, hard, durable grains of quartz or other hard durable rock, free from loam or clay, surface coatings and deleterious materials.

Stone dust must meet or exceed the following gradation:

100% passing 3/8"  
90-100% passing #4  
80-100% passing #8  
50-80% passing #16  
25-60% passing #30  
10-30% passing #50  
2-10% passing #100  
0-3% passing #200  
FM = 2.6-2.9

Color shall be dark gray.

Weed barrier fabric shall be a free draining geotextile commonly used to prevent vegetation growth that can be placed between layers of soil.

## CONSTRUCTION

Place, grade and compact at the lines and grades as shown on the plans and as directed by the Engineer. The stone dust shall be spread and compacted to yield a compacted depth of 4 inches and shall be compacted to the satisfaction of the Engineer using either power rollers or tamping rollers or other devices approved for use by the Engineer.

## COMPENSATION

Stone dust will be measured by the ton, complete in place.

Stone dust will be paid for at the Contract unit price per ton, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for weed barrier fabric, but all costs in connection therewith shall be included in the Contract unit price bid.

**ITEM 706.38****GRANITE PIER****EACH****DESCRIPTION****General**

The work under this item shall conform to the relevant provisions of Section 501 of the Standard Specifications and the following:

The work shall include the installation of granite piers as dimensioned and where shown on the plans, and as directed by the Engineer. All sides of the pier shall have an inset area wherein a section of engraved granite shall be securely grouted. Details of the engraving are included at the end of this section. The Contractor shall obtain vectorized artwork from the Town Engineer.

**MATERIALS**

Materials shall meet the requirements specified in the following Subsection of Division III, Materials:

**GraniteM9.04.8**

Stone for pier shall be of structural granite, hard and durable. Stone for the inset plaque shall be of similar color granite. Samples to be provided to the Engineer and the Town of Acton. Granite shall be free from seams that impair its structural integrity of smooth splitting character. Natural variations characteristic of the deposit will be permitted. Granite shall come from an approved quarry. Test samples shall conform to the requirements of ASTM C615. Granite material shall meet to the following minimum requirements:

1. Abrasion: 70.0 Ha.
2. Absorption: 0.4% (average).
3. Compressive strength: 19,000 psi (average).
4. Modulus of rupture: 1,500 psi (average).

Anti-graffiti sealer shall be a clear, penetrating, protective, ready to use microemulsion concentrate of silanes and aligomeric alkyl alkoxysilozanes. The protective anti-graffiti sealer shall comply with all known regulations limiting Volatile Organic Compounds (VOC) content. Upon reaction with the surface and humidity, it shall be chemically bonded into the substrate. Properly applied, it shall not produce a surface build up, darkening or other effect on the natural color or texture of the surface. Sealer and anti-graffiti coating shall exhibit the following physical properties or equivalents:

Form: Clear amber liquid

Specific Gravity: 1.000

Flash Point: 77° F.

VOC: 2.65 lbs/gallon (ASTM D5095)

Solids: 100% concentrate.

## CONSTRUCTION METHODS

The Contractor shall submit shop drawings to the Engineer for approval. After approval by the Engineer, fabrication and engraving of the granite may proceed.

Lifting and handling of all granite work shall be done with fabric or leather straps. No chains will be permitted.

### Anti-Graffiti Sealer

All caulking, patching and joint sealants shall be installed prior to application of the sealer. Surfaces shall be cleaned free of dust, surface dirt, efflorescence and contaminants. Surfaces to be treated shall be dry and absorbent to assure good penetration of the sealer.

A test application is necessary on each surface to be treated to insure compatibility and desired results. Tests shall be applied using the same equipment as for job application. Test areas shall be available for inspection by the Engineer throughout the job application.

Apply anti-graffiti sealer in accordance with the manufacturer's instructions. Preferred method of application shall be with low pressure (20 PSI) airless spray equipment or with a heavily saturated brush or roller. Set sprayer to produce a wet stream. Avoid atomization of the material. Apply sufficient material to thoroughly saturate the surface, making sure to brush out excess material that does not penetrate. Apply solution of anti-graffiti sealer within eight hours of dilution.

**Flat Surfaces:** When applying to flat surfaces, sealer shall be applied in a single saturating application with sufficient material applied so that the surface remains wet for three minutes before penetration into the granite and concrete. Surface residues, pools and puddles shall be broomed out thoroughly until they completely penetrate into the surface. Excess material should be picked up within a few minutes to avoid a surface buildup. Protect surfaces from rainfall for a minimum of four hours. Sealer requires 72 hours to develop its full water repellent effectiveness.

**Vertical Surfaces:** When applying by spray, apply in a saturating application from the bottom up. Apply sufficient material to create a 4 inches to 8 inches rundown below the spray contact point. Allow the first application to penetrate the masonry surface for three minutes and then re-apply in the same saturating manner. Less material will be required for the second application. When using a brush or roller, apply uniformly using sufficient material to saturate the surface.

Allow the sealer to penetrate the masonry surface for three minutes. Brush out heavy runs and drips that do not penetrate.



### Granite Pier

Exposed surfaces for Granite Pier shall be finished as follows:

- 1) Top shall be sawn with thermal finish.
- 2) Sides shall be split and dressed on two opposite sides so that the surface does not vary more than  $\frac{3}{4}$  of an inch in any direction, inward or outward. Within 1.5 inches of each corner, dressing shall be increased so that variation does not exceed 0.2 inches. The arris line of the corner (vertical edge) should not vary more than 0.04 inches from being straight. The remaining two opposite sides shall be sawn face with thermal finish.

The exposed surface of the granite logo area shall be lightly sandblasted. Some areas of the logo shown at the end of this section shall receive a heavy 0.08 inch depth sandblast. See existing logo for details. Letters and linework shall also be carved or sandblasted a minimum of 0.08 inches deep. Text letters, lines and background shall receive a high quality black "Lithochrome" coating to be approved by the Engineer.

The Contractor shall submit shop drawings for location and fabrication of piers and a sample of granite with all finishes. The Contractor shall also submit shop drawings and samples of sandblasted/ lithochrome image for Engineer's approval prior to fabrication.

Set piers absolutely plumb and at the height shown on the Drawings. Engineer shall approve exact facing of the pier front in the field prior to installation. Apply anti-graffiti sealer to entire exposed surface of pier as per manufacturer's written recommendations.

### COMPENSATION

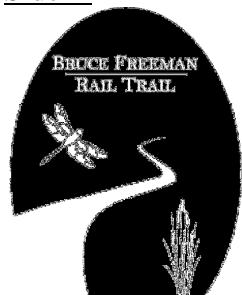
Granite Pier will be measured for payment by the each complete in place.

Granite Pier will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment, and incidental costs required to complete the work.

### ENGRAVING DETAILS

#### Granite Pier Station 103+22

##### Side A



**Lowell – 9.9 miles←**  
**Carlisle – 1.2 miles←**  
**Concord 3.4 miles→**  
**Framingham – 15.1 miles→**

##### Side B



Side C



Lowell – 9.9 miles→  
Carlisle – 1.2 miles→  
Concord 3.4 miles←  
Framingham – 15.1 miles←

Granite Pier Station 247+11

Side D



Side A



Side B



Carlisle – 4.0 miles↑  
Lowell –12.7miles↑

Side C



Side D



Concord – 0.6 miles↑  
Lowell –12.3 miles↑

**ITEM 707.1****PARK BENCH****EACH****GENERAL**

The work under this section will be to furnish and install benches as specified below and on the Plans.

**Reference Standards**

ASTM - American Society for Testing and Materials

**Quality Assurance**

1. Source: For each type of product required for the work of this Section, provide products of one manufacturer and source for consistency.
2. Codes and Standards: Perform site furnishings work in compliance with applicable requirements of governing authorities having jurisdiction. Workmanship and finish shall be equal to the best practice of modern shops for each item of work.
3. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.
4. The work of this Section shall be completely coordinated with the work of other Sections. Verify dimensions and work of other trades which adjoin materials of this Section before installing items specified.
5. Protect site furnishings from paint spatter, splashed concrete, and other construction damage by wrapping and taping in place plastic sheeting or heavy kraft paper until adjacent work is completed. Repair any damage to finish in a manner consistent with manufacturer's recommendations.

**Submittals**

1. Shop Drawings: Supply shop drawings at an approved scale for location, installation and erection of each site furnishing item under this Section.
2. Product Data: Provide manufacturer's product data showing installation and limitations in use of each site furnishing item. Supply Certificates of Compliance for all materials required for fabrication and installation.
3. Material Selection and Samples: Submit samples showing the complete range of colors, textures and finishes available for all components required for construction.

**MATERIALS**

Model number and manufacturer shall be Bench #ES400 with #ES401, manufactured by Wabash Valley Manufacturing, ph: 1-800-253-8619, slats style, black color, surface mounted with center arm rest, or approved equal manufactured by one of the following:

1. DuMor Inc. ph: 717-436-2106
2. Victor Stanley, Inc. 1-800-368-2573

## CONSTRUCTION

### General

1. Site furnishings shall be erected as indicated on the Drawings, plumb, level, snug, and free from rocking. Make necessary shimming and final adjustments.
  - A. Shims shall be stainless steel sized so that they do not protrude beyond the base of the item so as to be visible in completed installation
2. Exposed metal surfaces shall be finished in accordance with Section M7, Paints and Protective Coatings, except as noted otherwise.
3. Foundations shall be as shown on the drawings or as recommended by the manufacturer. Anchor bolts shall be cored into the foundations and an approved outdoor epoxy used to set anchor bolts into foundations.

### Benches

- A. Benches shall be located as indicated on the Drawings.
- B. Bench shall be surface mounted to pavement in accordance with manufacturer's recommendations.

## COMPENSATION

Park bench will be measured for payment by the each unit installed, complete in place.

Park bench will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for foundations, anchor bolts and epoxy, but all costs in connection therewith shall be included in the Contract unit price bid.

### **ITEM 707.15**

### **PARK BENCH REMOVED AND RESET**

### **EACH**

#### GENERAL

The work under this section will be to remove and reset the park benches at the North Acton Recreation Area as specified below and on the Plans.

When removing the park benches, the Contractor shall take all precautions to avoid damaging the bench. It shall be moved as a complete unit. Any bench not scheduled for immediate reinstallation shall be safely stored by the Contractor in a designated location, and the Contractor will be responsible for its safekeeping. The Contractor shall salvage all fasteners such as nuts, bolts, and other incidental hardware for reuse.

The Contractor shall take all precautions necessary to protect the benches and hardware from damage during this relocation work. The Contractor shall repair any damage caused by his operations or shall replace any components damaged beyond repair, all without compensation.

The bench shall be secured on a foundation in accordance with the relevant provisions of Section 901. The new concrete foundations shall be poured to the dimensions shown on the detail in the plans for the proposed park bench.

### COMPENSATION

Park bench removed and reset will be measured for payment by the each, complete in place.

Park bench removed and reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

### ITEM 707.7

### DISPLAY BOARD

### EACH

### DESCRIPTION

The work under this item shall include the fabrication and installation of the display boards as detailed and where shown on the plans, as directed by the Engineer and as follows:

### MATERIALS

Materials shall meet the following:

Framing members shall be No. 1 Structural Grade Southern Yellow Pine cut to the dimensions shown in the construction details. All wood shall be stained a color approved by the Southwick Historical Society.

Shingles shall be Red Cedar.

All hardware shall be galvanized.

Footing connections shall be constructed from galvanized steel.

Reinforcing Steel shall meet the requirements of Section 901 of the Standard Specifications.

Concrete for the footings shall be 4000 PSI, ¾ inch, 610 cement concrete and shall meet the requirements of Section 901 of the Standard Specifications.

### CONSTRUCTION

The display boards shall be constructed as shown in the construction plans and details.

### SUBMITTALS

At least 30 days prior to intended use, the Contractor shall provide the following submittals of the display board to the Engineer for review. The Contractor shall not order materials for the display board until the Engineer's review has been completed.

### Shop Drawings:

Submit Shop Drawings for the display board, display board footings, and footing connections. Shop Drawings for the display board footing and footing connection shall be stamped by an Engineer Registered in the State of Massachusetts.

**Manufacturer's Product Literature:**

Submit manufacturer's material descriptions and installation instructions for the display board.

Color Samples: Submit color samples for approval by the Engineer. Color Samples shall be a minimum of 3 inch by 3 inch and shall be of the same material to be used to construct the display board.

**COMPENSATION**

Display Boards will be measured for payment by each display board installed, complete in place.

Display Boards will be paid for at the Contract unit price per each display board installed, which price shall include all labor, materials, equipment, submittals, and incidental costs required to complete the work to the satisfaction of the Engineer.

**ITEM 707.81****REMOVABLE BOLLARD****EACH****DESCRIPTION**

Work under this item shall consist of installing removable bollards as shown on the plans and where directed by the Engineer.

**MATERIALS**

Steel: bollards shall be schedule 80 steel pipe size as indicated on the drawings. Steel shall conform to ASTM A36 and shall be galvanized in accordance with relevant sections of ASTM A123 or ASTM A386 to assure proper bonding of paint to steel surfaces exposed to the weather.

Cast Iron Cap: shall conform to and meet all current requirements of the American Standards Association and the American Society for Testing Materials of 48-class 25 for gray cast iron. Cap shall be of one piece construction and shall be true to the drawings and sample furnished. The shaft of the cap shall be equipped with three (3) Hex Socket Set screws spaced 120 degrees apart securely fastening the cap to the post. The cap shall be tack welded after approval by the engineer for orientation and alignment to prevent removal.

The contractor shall submit one painted bollard complete with cast iron cap to the Engineer for approval. After approval by the Engineer, fabrication of the pavement bollards on the site may proceed but must match the sample in quality and materials.

All castings shall be true to drawings and the sample furnished. They shall have a dense smooth surface, uniform quality of appearance, free from blow holes or runoffs, porous spots, hard spots and shrinkage faults and cracks.

All castings shall be thoroughly and carefully cleared of all sand, scale and fins. They shall be free from marks of core anchors, projections and imperfections.

The contractor shall submit shop drawings to the Engineer for approval. After approval by the Engineer, fabrication of the bollards may proceed.

Paint shall conform to current standards and be subject to the approval of the Engineer. Color is black.

## CONSTRUCTION

1. Metal Workmanship: Work shall be executed only by mechanics experienced in the trade. Welding shall be done by certified welders only. The Contractor shall obtain the exact dimensions and will be held responsible for the accurate erection of all parts of this work. Cut, fit and drill as necessary for proper assembly and installation of all work for attaching items of other trades.

All joints exposed to the weather shall be formed to exclude water. All welds wherever visible shall be ground smooth, filed and shall present an appearance of a complete homogeneous metal.

2. Metal Fabrication: Shop fabrication shall be welded. Steel shall be well-formed to shape and sized for shape lines or angles. Shearing and punching shall leave clean, true lines and surfaces. Casting shall be sound and free from warp, holes and other defects that impair their strength and appearance. Exposed surfaces shall have a smooth finish with sharp, well-defined lines and arises. Machine joints, where required, shall be milled to a close fit. Thickness of metal and details of assembly shall give ample strength and stiffness.
3. Hot-Dip Galvanizing: All exterior ferrous metal mentioned under Metal Fabrication and Metal Workmanship above shall be hot-dip galvanized.
4. Surface Treatment: Metal finishes shall be painted. Color is black.
5. Attachment: Bollards shall be anchored into the concrete base as shown in the details on the drawings.

Install bollards, level and plumb at locations indicated on the plans in accordance with approved shop drawings. Coordinate sequence of operation in planning footings and installation of surrounding pavement.

Protect bollards from paint spatter, concrete splashes and other construction damage by wrapping in plastic sheeting or heavy kraft paper and taping in place. Do not remove until adjacent work is completed. Repair any damage to painted finish.

**COMPENSATION**

Removable bollard will be measured for payment by the each, complete in place.

Removable Bollard will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for hardware, cap, concrete and gravel base, but all costs in connection therewith shall be included in the Contract unit price bid.

**ITEM 707.9****BICYCLE RACK****EACH****DESCRIPTION**

Work under this item shall conform to the relevant provisions of Sections 700 and 901 of the Standard Special Specifications and the following.

Bike Rack shall be Inverted “U” or “A” style rack as defined in the “Bicycle Parking Guidelines” published by the Association of Pedestrian and Bicycle Professionals and shall accommodate two bicycles.

**Standards**

Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

ASTM	American Society for Testing and Materials
AASHTO	American Association of State Highway and Transportation Officials
SPIB	Southern Pine Inspection Bureau
AWPA	American Wood Preservatives Associations
AWS	American Welding Society
SSPC	Steel Structures Painting Council
NBGQA	National Building Granite Quarries Association, Inc. “Specifications for Architectural Granite”

**Submittals**

Contractor shall submit all shop drawings, manufacturers’ product data, and samples in accordance with Division I. Shop drawings will be returned to the Contractor for resubmission if required information is incomplete. Verify all dimensions in the field before shop drawings are submitted.

Shop Drawings and Manufacturer’s Specifications: Contractor shall submit shop drawings of every item listed in this Section. Drawings shall include plans, sections and details as required to show all materials and reinforcing, layout, dimensions, jointing, method of connection and assembly, fabrication and tolerances for types of materials, types and details of connections and openings, cuts, holes, bolts, plates, concrete footings, reinforcing and finishing, anchors and fasteners, attachment details, and painting and finishing for all items required. Coordinate trades as required.



Certificate of Compliance: Submit manufacturer's certification that Bike Racks have been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

Refer to Section 901, CEMENT CONCRETE MASONRY for submittal requirements for all foundations, footings, and reinforced concrete structures.

Manufacturer's Literature: Submit product data including details of construction, materials, dimensions, analysis, hardware preparation, color charts and specific finishes, and label compliance.

Submit manufacturer's products and material descriptions and/or installation instructions for the following items:

1. Bike Rack

Galvanizing and Painting Certification

Furnish to the Engineer notarized certificates of compliance with ASTM and AASHTO requirements specified in this Section for each item.

Submittals to Department at Acceptance

Deliver Bike Racks in packaging that provides protection during transit and job storage. Provide additional protection to prevent damage to the finish of the Bike Racks.

Upon delivery, inspect Bike Racks for damage. Minor damage may be repaired provided that refinished items are equal in all respects to new Work and acceptable to the Engineer; otherwise, remove and replace damaged items.

Store Bike Racks on site under cover. Place units on minimum 4-inch wood blocking. Avoid use of protective materials that trap heat and moisture. If protective covering on any Bike Rack becomes loose or wet, remove immediately, dry, replace, and resecure cover until installation. Secure all items from damage for any reason, including vandalism, and theft.

Quality Assurance, Warranties, Guarantees, and Replacement

Contractors shall provide materials from the same manufacturer for site items consistent throughout the project and shall install according to manufacturer's instructions for the specific condition as shown in the Drawings.

Contractor shall provide to the Department the written maintenance and operational instructions, all warranties, and guarantees provided by the Manufacturers for the specific improvements and finishes, for a minimum of one year after Final Acceptance. If Manufacturer does not provide warrantee for materials installed, Contractor shall assume all cost for replacement of specified material, if product fails during warrantee period.

Contractor shall provide a guarantee of minimum of one year after acceptance of Workmanship and against defect as determined by the Department, and shall completely replace or repair site improvements at their own expense within two months after item is identified in the field.

## MATERIALS

### General

Provide all materials from new stock, free from defects impairing strength, durability and appearance, and of best commercial quality for the purpose specified.

All items shall be packaged and wrapped appropriately for delivery and storage, completely covered and protected from damage.

Items shall be stored high and dry and covered and protected from the elements until ready for installation.

Deliver items with original manufacturer's name labels, instructions, and warranties.

Contractor shall be required to replace items that are damaged during delivery, storage and installation.

Supply all equipment hardware and necessary accessories required for complete, operating and installed site improvement item specified herein.

All hardware shall be fabricated from steel conforming to ASTM A36 and shall be galvanized by the hot-dip process in conformity with ASTM A153-73 for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, unless otherwise specified as stainless steel conforming to ASTM Type 316 and 317 stainless steel bolts, anchors, clips, and fasteners shown on the Drawings and indicated herein.

Provide all exposed fasteners of the same material, color and painted finish as the fastened material unless otherwise indicated in the Drawings and specified herein.

Provide all exposed fasteners vandal-proof (spanner-head type), unless otherwise noted in the Drawings or specified herein. Some items will require removal for regular maintenance or for other uses. Provide fasteners and sleeves that allow for removal without damaging the fasteners or the item.

Concrete for footings for Bike Racks, as indicated on the Drawings, shall be steel reinforced Portland Cement Concrete – 3,500 PSI. Refer to the Drawings for concrete reinforcing and to that Section for submittal, testing, and design requirements.

For galvanized, painted, and/or coated steel finishes: Refer to the Item for requirements.

Color shall be black.

## CONSTRUCTION METHODS

### General

All items located on the Drawings shall be fabricated and installed by the Contractor as detailed on the Drawings, as per manufacturers' written installation procedures and as directed by the Engineer. All fabrication and installation Work shall be accomplished using the highest standards of Workmanship and shall include all excavation, concrete for footings, labor, transportation, storage, and incidentals to make the Work complete.

### Project Conditions

Installation of items shall follow Manufacturer's guidelines for project conditions during installation.

Contractor shall schedule delivery of items and all necessary equipment and hardware so as to arrive at the site in a timely manner to comply with construction schedule and minimize on-site storage times. The Contractor shall be ready to discuss the purchasing of Bike Racks at the beginning of the Contract so suitable arrangements can be made to meet the date of completion. Items delivered to the site prior to scheduled installation time shall be stored in a secured staging area with all small components retained separately by the Contractor. Protect all items from weather, careless handling, and construction in the vicinity, vandals or pilferers.

Stake locations of all items in the field for approval by the Engineer before commencing any excavation or footing installations.

Contractor shall install all furnishings and Site Improvements level and with plumb vertical alignment, and as otherwise indicated on the Drawings. All fasteners shall be as specified by the manufacturer and/or as shown on the Drawings and specified herein. Fasteners shall be of correct and appropriate size, vandal resistant, tight, and secure, and shall be trimmed to appropriate lengths so as not to protrude beyond nut and be a safety hazard and shall match color of adjacent metal.

Any incidence of damage, vandalism, or theft of any item during installation shall be reported immediately to the Engineer, remedial action shall be decided, and repairs made to the satisfaction of the Engineer. The Contractor is required to secure all items of the Work from access by the Public until Final Acceptance.

Verify all field conditions before submitting shop drawings.

Cutting, painting (other than touch-up), and welding in the field will not be permitted.

### Excavation

After approval of all shop drawings, execute all excavations according to Section 120, EXCAVATION and Section 140, EXCAVATION FOR STRUCTURES before proceeding within work area so as to avoid disruption of existing materials to remain or newly installed items. Any items damaged by excavation which are to remain or are newly installed shall be replaced or repaired to existing conditions by the Contractor at no cost to the Department.

### Concrete Footings and Structures

Placement of gravel borrow or backfill, when indicated on the Drawings, shall be as specified in Section 400 of the Standard Specifications and the Drawings.

Installation of all concrete footings and bases, form Work, reinforcing, curing, testing and protection shall be as specified in Section 901 CEMENT CONCRETE MASONRY and as shown on the Drawings. Dimensions, grades, and imbedded hardware shall be as indicated on the Drawings and specified herein. Secure and brace all imbedded hardware and objects in concrete in a true and vertical position until cured.

Contractor shall finish all concrete surfaces which will remain at finished grade by troweling all surfaces smoothly to drain away from installed item, tooling all edges neatly with rolled edges and corners and protecting surfaces from the sun, wind and vandalism until cured. Wrap and protect all imbedded anchor bolts.

### Bike Rack Installation

Install Bike Racks in accordance with manufacturer's instructions. Refer to the specific site elements and the Drawings for horizontal and vertical alignment. Anchor Bike Racks, securely and according to manufacturer's instructions and the Drawings, to concrete footings and pads with stainless steel anchor bolts and fasteners with lock-tight washers.

Review layout of Bike Racks for approval in the field with Engineer before footings and improvements are installed.

Bike Racks shall be securely installed to a 1/32 inch tolerance overall and shall be installed plumb and level, unless otherwise shown in the Drawings. Items that fall outside of this tolerance shall be required to be reset to meet tolerance, as a condition of acceptance. Bolts and fasteners shall be trimmed to safe length, as applicable and with review by the Engineer.

Protect all stored and installed Site Improvements from damage, use, theft or vandalism until acceptance. Contractor shall adjust, repair, or replace damaged, missing, or unacceptable items at their own expense. Site items shall be clean, and finishes as specified as condition of acceptance. Clean with non-abrasive means, careful not to damage finishes.

### COMPENSATION

Bike rack will be measured for payment by each, installed, complete in place.

Bike rack will be paid for at the Contract unit price each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 710.8****GRANITE MARKER****EACH**

The work shall include the installation of granite markers as dimensioned and where shown on the plans, and as directed by the Engineer.

**MATERIALS**

Materials shall meet the requirements specified in the following Subsection of Division III, Materials:

**GraniteM9.04.8**

Stone for pier shall be of structural granite, hard and durable. Samples to be provided to the Engineer and the Town of Acton. Granite shall be free from seams that impair its structural integrity of smooth splitting character. Natural variations characteristic of the deposit will be permitted. Granite shall come from an approved quarry. Test samples shall conform to the requirements of ASTM C615. Granite material shall meet to the following minimum requirements:

1. Abrasion: 70.0 Ha.
2. Absorption: 0.4% (average).
3. Compressive strength: 19,000 psi (average).
4. Modulus of rupture: 1,500 psi (average).

Anti-graffiti sealer shall be a clear, penetrating, protective, ready to use microemulsion concentrate of silanes and aligomeric alkyl alkoxysilozanes. The protective anti-graffiti sealer shall comply with all known regulations limiting Volatile Organic Compounds (VOC) content. Upon reaction with the surface and humidity, it shall be chemically bonded into the substrate. Properly applied, it shall not produce a surface build up, darkening or other effect on the natural color or texture of the surface. Sealer and anti-graffiti coating shall exhibit the following physical properties or equivalents:

Form: Clear amber liquid

Specific Gravity: 1.000

Flash Point: 77° F.

VOC: 2.65 lbs/gallon (ASTM D5095)

Solids: 100% concentrate.

**CONSTRUCTION METHODS**

The Contractor shall submit shop drawings to the Engineer for approval. After approval by the Engineer, fabrication and engraving of the granite may proceed.

Lifting and handling of all granite work shall be done with fabric or leather straps. No chains will be permitted.

### Anti-Graffiti Sealer

All caulking, patching and joint sealants shall be installed prior to application of the sealer. Surfaces shall be cleaned free of dust, surface dirt, efflorescence and contaminants. Surfaces to be treated shall be dry and absorbent to assure good penetration of the sealer.

A test application is necessary on each surface to be treated to insure compatibility and desired results. Tests shall be applied using the same equipment as for job application. Test areas shall be available for inspection by the Engineer throughout the job application.

Apply anti-graffiti sealer in accordance with the manufacturer's instructions. Preferred method of application shall be with low pressure (20 PSI) airless spray equipment or with a heavily saturated brush or roller. Set sprayer to produce a wet stream. Avoid atomization of the material. Apply sufficient material to thoroughly saturate the surface, making sure to brush out excess material that does not penetrate. Apply solution of anti-graffiti sealer within eight hours of dilution.

**Flat Surfaces:** When applying to flat surfaces, sealer shall be applied in a single saturating application with sufficient material applied so that the surface remains wet for three minutes before penetration into the granite and concrete. Surface residues, pools and puddles shall be broomed out thoroughly until they completely penetrate into the surface. Excess material should be picked up within a few minutes to avoid a surface buildup. Protect surfaces from rainfall for a minimum of four hours. Sealer requires 72 hours to develop its full water repellent effectiveness.

**Vertical Surfaces:** When applying by spray, apply in a saturating application from the bottom up. Apply sufficient material to create a 4 inches to 8 inches rundown below the spray contact point. Allow the first application to penetrate the masonry surface for three minutes and then re-apply in the same saturating manner. Less material will be required for the second application. When using a brush or roller, apply uniformly using sufficient material to saturate the surface.

Allow the sealer to penetrate the masonry surface for three minutes. Brush out heavy runs and drips that do not penetrate.

### Granite Pier

Exposed surfaces for Granite Pier shall be finished as follows:

- 1) Top shall be apex with thermal finish.
- 2) Sides with engraving shall be sawn face with thermal finish.
- 3) Opposite sides shall be sawn with rough cut finish.

One side shall be engraved with the "MILE XX" and the Town name as shown on the detail in the plans. Text for "MILE XX" shall be 2.5" high, Tahoma Font and painted black. Town name shall be 0.75" high, Tahoma font and painted black.

The Contractor shall submit shop drawings for location and fabrication of markers and a sample of granite with all finishes.

Set markers absolutely plumb and at the height shown on the Drawings. Engineer shall approve exact facing of the marker front in the field prior to installation. Apply anti-graffiti sealer to entire exposed surface of pier as per manufacturer's written recommendations.

#### COMPENSATION

Granite marker will be measured for payment by the each complete in place.

Granite marker will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment, and incidental costs required to complete the work.

#### ITEM 714.2

#### MILE MARKER REMOVED AND RESET

#### EACH

The work shall include removing and resetting existing concrete and granite posts and slabs used as mile markers at Stations 44+54, RT and 266+35, RT as shown on the plans. If additional mile markers are found and will be impacted, they shall be reset by the Contractor per this item.

Wood blocking shall be used for protection when moving the mile marker. The marker shall be fully supported. The direction of text and burial depth shall be noted. One side of the mile marker shall be excavated to the base of the marker to determine if it was set in a foundation. The marker shall be excavated, stored in a secure location and reset at the location shown on the plans. The marker shall be placed plumb and in the same orientation, to the depth noted during excavation.

#### COMPENSATION

Mile marker removed and reset will be measured for payment by the each, complete in place.

Mile marker removed and reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

#### ITEM 714.3

#### RAILROAD SIGNAL POLE REMOVED AND RESET

#### EACH

The work shall include removing and resetting existing signal poles located at Stations 261+42, RT, 262+80, RT, 264+18, RT, 264+21, RT, 265+51, RT and 266+87, RT along the existing railroad right of way as shown on the plans. If additional signal poles are found and will be impacted, they shall be reset by the Contractor per this item at the discretion of the Engineer.

The poles shall be carefully removed. Any cross arm and bracing that exists on the poles shall be retained and removed with the pole. If necessary, new mounting hardware shall be provided to connect the cross arm to the pole. Any existing signal cabling shall be removed and disposed. The burial depth shall be noted. The pole shall be excavated, stored in a secure location and reset at the location shown on the plans. The pole shall be reset to the depth noted during removal. If the existing depth is too shallow to support the pole height, the pole shall be set to a depth consistent with current practice.

**COMPENSATION**

Railroad signal pole removed and reset will be measured for payment by the each, complete in place.

Railroad signal pole removed and reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 714.4****WHISTLE POST REMOVED AND RESET****EACH**

The work shall include removing and resetting existing whistle posts at Stations 201+77, LT, 234+88, RT and 249+58, RT as shown on the plans. If additional whistle posts are found and will be impacted, they shall be reset by the Contractor per this item.

Wood blocking shall be used for protection when moving the whistle posts. The posts shall be fully supported. The direction of text and burial depth shall be noted. One side of the whistle post shall be excavated to the base of the post to determine if it was set in a foundation. The post shall be excavated, stored in a secure location and reset at the location shown on the plans. The post shall be placed plumb and in the same orientation, to the depth noted during excavation.

**COMPENSATION**

Whistle post removed and reset will be measured for payment by the each, complete in place.

Whistle post removed and reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 719.****TRACK SWITCH REMOVED AND RESET****EACH**

The work shall include removing and resetting existing manual track switch located at Station 76+85, LT as shown on the plans. If additional switches are found and will be impacted, they shall be reset by the Contractor per this item.

The connecting rod shall be disassembled and the switch removed from the railroad ties. The existing connecting rod and other switch components connected to the rails, the ties and rails shall be removed and disposed of under other items in the Contact.

The track switch shall be stored in a secure location and reset at the location shown on the plans. New mounting hardware may be required. The switch shall be mounted to two railroad ties, approximately six feet in length. The switch shall be mounted two feet from one end. The ties shall be buried such that only two inches remain exposed at the switch. The tracks shall be completely embedded in the slope on the side of the paved bikeway.



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**COMPENSATION**

Track switch removed and reset will be measured for payment by the each, complete in place.

Track switch removed and reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 734.2****SIGN-INTERPRETIVE-NPS STANDARD****EACH**

The work under this item shall consist of providing and installing an information sign.

**MATERIALS**

- A. Sign-Interpretive
- B. Graphic Panel
- C. Associated materials for installation

**Sign**

The sign shall be a cantilevered model with two side-mounted posts that support the graphic panel mounted at a 45 degree angle. The sign will include 2 posts, backing panel graphic panel and the outer frame. The sign will be an in-ground installation as shown in the drawings and per manufacturer's recommendation.

The posts will be two inch by three inch (min.) dimensional rectangular stock. The post will be fifty inches from the base and then extending twenty-six and one half inches at a 45 degree angle.

The frame dimensions will be 38 inches by 26 inches. The visible opening for the graphic panel will be 35 inches by 23 inches. The top rail will be removable to allow installation of the graphic panel.

**Graphic Panel**

The porcelain enamel graphic panel will be fabricated from 16 guage steel. Finished panel thickness will be 1/8" thick (max.) to slide into sign frame. Graphic panel background color will be a light brown (Federal Standard-Brown *FS 30475*). Text will be black (Federal Color Standard-Black *FS 37038*). Font will be Verdana. Other text and image details will be worked out through the shop drawing review process to the mutual satisfaction of both parties after award of contract.

Text for the graphic panel will be:

**INCLUDED IN THE PS&E SUBMISSION**

The electronic file for the graphic panel text and image will be available from:

Kurt Jergensen  
Historic Bridge Specialist  
Environmental Services  
Massachusetts Highway Department  
10 Park Plaza – Room 4260  
Boston, MA 02116  
Telephone: (857) 368-8802  
Fax: (857) 368-0609  
Email: [kurt.jergensen@state.ma.us](mailto:kurt.jergensen@state.ma.us)

The Contractor will provide a mock-up of the panel text prior to fabrication and installation for approval by the Engineer and Cultural Resources (See contact name above).

The sign will be from one of the following sources or approved equal:

Company	Model	Color	Comments
KVO Industries, Inc. 1825 Empire Industrial Court, Suite A Santa Rosa, CA 95403 Ph. (707) 573-6868 <a href="http://www.kvoindustries.com">www.kvoindustries.com</a>	Outline Cantilever Sign Model # 3826 OL CAN-AL	(Brown Fine Texture Semi Gloss)	
Winsor Fireform 3401 Mottman Road SW Tumwater, WA 98512 Ph. (800) 824-7506 <a href="http://www.winsorfireform.com">www.winsorfireform.com</a>	NPS-Style Cantilevered Low Profile Base (CFF)	(NPS Dark Brown)	
Best-Ex, Inc. 820 Industrial Court PO Box 454 Baraboo, WI 53913 Ph. (800) 356-4883 <a href="http://www.best-exfab.com">www.best-exfab.com</a>	NPS -Style Frame with Cantilever Exhibit Base	(NPS Dark Brown)	

### CONSTRUCTION METHODS

The sign will be located at approximately Station 140+20 LT as shown on the plans. Final sign post location will be marked and approved by the Engineer prior to start of work. Sign post holes will be excavated to the dimensions shown on the detail drawings to the appropriate depth and circumference. The sign will be completely assembled prior to setting it in the hole. Protect the sign from damage during installation. Do not install the graphic panel until the sign has been completely installed. Set sign to the proper elevation (Refer to manufacturer's specifications and drawings). Check sign again to ensure that it is plumb after backfilling and set with temporary bracing to prevent shifting until backfill concrete completely sets. Excavation, removal of excavated material, placement of the sign and backfilling the sign post holes, other associated labor, tools and costs are incidental to the Sign-Information pay item.

## COMPENSATION

Sign-interpretive-NPS standard formation shall be measured for payment per each, complete and in place. Unit of measurement shall include one Sign-Information constructed and installed as described above.

Sign-Information shall be paid for at the Contract unit price, per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

### **ITEM 740. ENGINEERS FIELD OFFICE AND EQUIPMENT (TYPE A) MONTH**

The work under this item shall conform to the relevant provisions of Section 740 of the Standard Specifications and the following:

Two computer systems and a digital camera meeting the requirements set forth below including installation, maintenance, power, paper, disks and other supplies shall be provided at the Resident Engineer's Office:

#### The Computer Systems shall meet the following minimum criteria or better:

Case:	Small form factor
RAM:	4 GB
Hard disk:	500GB, 7200RPM
Monitor:	24" LCD with Built-in speakers
DVD-RW/CD-RW:	Combo drive including DVD $\pm$ RW
Network Adapter:	10/100 Mbit/s
USB Ports:	6 high-speed USB ports
Mouse:	Optical mouse with scroll, mouse pad included
OS:	Windows with all security updates
Web Browser:	Internet Explorer with all security updates
Applications:	Latest MS Office Professional with all security updates Latest Adobe Acrobat Professional with all security updates Antivirus software with all current security updates maintained through the life of the contract.
Internet access:	High speed internet access.
Flash drives:	2 - 8 GB USB
Multifunction Printer:	Color laser printer, fax, scanner, and copier – all with 600 x 600 dpi capability.

#### A Digital Camera shall meet the following minimum criteria or better:

Resolution:	10 Megapixel
Optical Zoom:	10X
Memory:	8 GB SD card
USB Port:	USB 2.0 with PC cable
Screen:	2-inch LCD with scratch-resistance and anti-reflectance
Battery Power:	2 sets of rechargeable batteries with battery charger
Carrying Case:	Rain-proof with shoulder strap
Video Capability with sound	

The Engineer's Field Office and the equipment included herein including the computer system and camera shall remain the property of the Contractor at the completion of the project.

Disks, flash drives, and card readers with cards shall become the property of the Department.

Twelve three ring binders, one inch thick with clear covers and side pockets shall be provided for the Engineer as incidental to the project and will become the property of the Massachusetts Department of Transportation - Highway Division.

Compensation for this work will be made at the contract unit price per month which price includes full compensation for all services and equipment, and incidentals necessary to provide equipment, maintenance, insurance as specified and as directed by the Engineer.

### **ITEM 751.7**

### **COMPOST TOPSOIL**

### **SQUARE YARD**

#### **GENERAL**

The purpose of this item is to provide compost mulch for erosion control and better seed establishment. Typically, hydraulic application equipment will be required for this item, unless otherwise permitted by the Engineer, in writing.

Unless otherwise specified on the drawings, depth shall be 4 inches.

#### **MATERIALS**

Coarse compost shall be compost meeting the requirements for Organic Soil Additives, Section M 1.06.0 of the Standard Specifications. No kiln-dried wood or construction debris shall be allowed.

Organic matter content shall be minimum 30 percent (dry weight basis) as determined by ASTM D2974 (method A) Standard Test Methods for Moisture, Ash and Organic Matter of Peat and Other Organic Soils.

Moisture content shall be 40-60 percent as measured by ASTM D2216 Standard Test Method for Laboratory Determination of Water Content of Soil and Rock and ASTM D2974 (cited above).

#### **CONSTRUCTION METHODS**

Contractor shall use stockpiled organics from the clearing and grubbing operation as compost. Compost shall be tilled into topsoil.

Prior to placement of compost, soil surface shall be free of stones larger than 2 inches in the largest dimension, and shall be tilled or tracked to ensure an uneven surface for mixing of compost and soil. Surface preparation shall be incidental to this item.

Compost shall be hydraulically applied unless otherwise permitted. Seed may be added to the hydraulically applied compost, however seed course shall be within ½ inch of the compost depth.

## COMPENSATION

Compost topsoil will be measured for payment by the square yard of compost installed, approved, and maintained in place.

Compost topsoil will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

### ITEM 754.2

### WOOD TURTLE PROTECTION PLAN BRUCE FREEMAN RAIL TRAIL PHASE 2A

### LUMP SUM

## DESCRIPTION

The work to be done consists of the monitoring and protection of turtles during the construction of Phase 2A of the Bruce Freeman Rail Trail in the three designated NHESP Focus Areas as shown on the plans or other areas so designated by the Engineer and in accordance with applicable environmental permits. The three focus areas include:

1. Focus Area 1 – Station 143+50 to 602+00 (2,650 feet)
2. Focus Area 2 – Station 188+50 to 195+00 & 203+00 to 225+00 (2,850 feet)
3. Focus Area 3 – Station 55+75 to 68+00 (1,225 feet)

## General

**This item outlines the requirements of the Natural Heritage and Endangered Species Program (NHESP) of the Division of Fisheries and Wildlife (DFW) for projects occurring in the vicinity of wood turtle populations.** The work to be done consists of the monitoring and protection of turtles during the construction of the Phase 2A of the Bruce Freeman Rail trail in Acton, MA.

It should be noted that if work is conducted in the inactive season, no sweeps are required. If the limit of work barrier is installed during the inactive season, no sweeps are required. If the barriers are installed during the active season sweeps are required of the limit of work prior to construction. The Contractor must coordinate this work with MassDOT to determine if the work can be staggered in the focus areas to avoid the active season.

## **Sweeps Prior to Vegetation Clearing and In-Water Cofferdam Installation**

The Turtle Monitor (Monitor) shall be a MassDOT biologist (Tim Dexter 857-368-8794 [timothy.dexter@state.ma.us](mailto:timothy.dexter@state.ma.us); Alex Murray 857-368-8811 [alex.murray@state.ma.us](mailto:alex.murray@state.ma.us)) approved by the Natural Heritage and Endangered Species Program (NHESP). The Monitor shall obtain a scientific collecting permit from the NHESP to handle wood turtles. The NHESP-approved Monitor shall visit the site prior to the start of major work activity, during tree clearing, after barrier fence installation, and prior to the start of all cofferdam phases; the Contractor and/or Resident Engineer shall coordinate with the Monitor at least 3 weeks prior to such work. The Monitor shall sweep the site prior to any site clearing, grubbing, or site preparations. The

Monitor shall inspect vegetation within 200' of wetland areas, prior to the establishment on the limit of work line.

The Monitor shall also provide a sweep of the site prior to any work in water. The Monitor shall inspect all areas of land under water where cofferdams are to be installed, paying close attention to overhanging banks. The Monitor shall conduct sweeps prior to cofferdam installation for all phases of the dewatering plan.

The Monitor shall visually sweep these areas immediately before machines enter the area, and relocate any turtles to suitable habitat immediately beyond the construction site. The Monitor shall provide contact information to the project supervisor in the event a wood turtle is discovered on-site. The Monitor may visit the site on only one day if the vegetation clearing and in-water work are initiated on the same day. Upon completion of sweeps, the Monitor shall provide the NHESP with a summary of activities at the construction site. This report shall include the number and duration of visits, and rare species observation forms for all state-listed species encountered. In the event of finding an injured turtle, the turtle shall be transported to a suitable veterinarian. In the event of finding a turtle with a radio transmitter, NHESP and the contact on the transmitter shall be alerted immediately.

All state-listed species encountered in or near the project shall be reported to the NHESP through a Rare Animal/Plant Observation Report with the required supporting materials within 10 days of the observation. No state-listed species may be removed from the project site unless under the direct supervision of the biologist or the NHESP.

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### **Establishment of a Limit of Work Turtle Barrier and Signage**

Following the sweep of the work site, a limit of work turtle barrier shall be installed as shown on the plans and the sketches in the Appendix of these Special Provisions. The limit of work and turtle barrier shall consist of straw bales and silt fence (silt fence as the outer boundary) and shall contain signage clearly identifying it as the limits of work. One sign per **XXX** linear feet **(to be determined by MassDOT Environmental)** of work barrier shall be furnished and installed by the Contractor as directed by the Monitor.

At four locations within the turtle barrier fence, the Contractor shall furnish a wooden gate to block turtle access to the work area. The gates shall be secured to the turtle barrier to prevent access to the work area during periods of no work. During active construction days, the gates can be opened/removed to allow for staging area access. At the end of the construction day the Contractor shall close/replace the gate, to ensure the turtle barrier is secured and prevents turtle access to the staging area. The Monitor will review and approve the gates prior to their implementation.

1. Installation of the barrier must be conducted using methods that result in a minimum of disturbance (i.e., hand-dug, "2-man" trencher or auger). It is not appropriate to clear large access paths prior to sweeps for turtle. No clearing may occur outside the limit of work approved by the NHESP.
2. The barrier must be composed of at least 2 1/2 feet of vertical barrier above ground and an additional 4-6 inches buried below ground.

3. The face of the material must be relatively smooth. Materials commonly used are staked at 6 - 10 foot intervals and include tightly woven geotextile, aluminum flashing, or other such materials stapled or tacked to stakes. Loosely woven geotextile fabrics, hay/straw bales, wattles or tubular materials are not generally sufficient. Tightly staked silt fence is appropriate.
4. The bottom of the barrier fabric must be carefully buried in a 4-6 inch deep trench. The trench must be backfilled and compacted. If it is not possible to dig a trench, then the bottom of the barrier must be affixed to the surfaced.
5. The straw bales used with silt fencing shall be installed on the work-side of the silt fence to avoid turtles using these to breach the barrier.
6. Once installed, the barrier shall be taut between the stakes. Slumps or loose materials will undermine the effectiveness of the barrier. In some circumstances, geotextile fabrics may need to be reinforced with backer material to ensure integrity. Backer material is typically similar to hardware cloth.

Once per week, a person familiar with barrier maintenance and installation shall inspect the barrier and facilitate any repairs or alterations. The limit of work barrier should remain taught between stakes and any holes along the bottom repaired.

Work barrier and signage shall be removed by the Contractor at the completion of the project or when approved by the Engineer. All material shall be removed and disposed of off-site by the Contractor.

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### **Construction Worker Training**

The Monitor shall provide to the construction foreperson wood turtle identification and handling pamphlets. All construction, landscaping, and other sub-contractors associated with the Project shall be informed in writing of the likely presence of State-listed Species on the Property and what measures (observation and injury) should be implemented to minimize direct harm to State-listed Species.

Further, no wildlife shall be removed from the Property without approval of a qualified wildlife biologist or the Division except as necessary to receive veterinary treatment in the case of harm during construction.

This protocol may require only one to three days of labor, including field surveys and correspondence with the NHESP.

### **COMPENSATION**

#### **Basis of Payment**

One-Time Sweeps Prior to Vegetation Clearing and In-Water Cofferdam Installation and Construction Worker Training:

There will be no payment for the work, as the Monitor will be provided to the contractor as a free service by MassDOT.





Establishment of Limit of Work Barrier and Signage:

Installation of a limit of work barrier and signage shall be paid at the lump sum bid price and shall be compensation for all labor, equipment and materials necessary for the successful installation, maintenance and removal of the work barrier and signage and the maintenance and removal of the system.

40% of the lump sum bid price shall be made following the installation of the barrier and signage. The remaining 60% shall be paid in 10% increments throughout the remaining period of the contract.

**ITEM 755.3****NON-TIDAL WETLAND MITIGATION AREAS****LUMP SUM**

Work under this item shall conform to the relevant provisions of Sections 120, 770, 771 and the following:

The work under this Item includes the furnishing of all labor, transportation, equipment, and materials required for protection, construction, and maintenance of Non-Tidal Wetland Mitigation Areas as compensation for proposed impacts to existing wetlands. Tasks include erosion controls, excavation, fine grading, soil and soil amendments as needed, planting, maintenance and removals as shown on the Plans.

The construction and re-vegetation of the replacement areas shall be in accordance with the Plans and Cross Sections and as directed by the Wetland Specialist. Limits of replacement and proposed plantings shown on the plans are approximate and may require adjustment in the field to accommodate actual conditions.

**DESCRIPTION OF WORK**

To ensure that no loss of wetland function results from the proposed project, Non-Tidal Wetland Mitigation Area(s) characterized by Bordering Vegetated Wetlands (BVW) shall be replicated through constructed wetlands and/or restored by planting in existing wetland areas shown on the Plans. Non-Tidal Wetland Mitigation Areas shall hereafter be referred to as Mitigation Areas. The following minimum area requirements shall be met for each area shown on the Plans.

Replication:

BVW replication area A = 1,233 sf.

Wetland Replication Area A is located west of Sta 29+00 through 30+00, south of the new accessway to the Bruce Freeman Rail Trail from the proposed parking lot in Acton. Wetland replication design specifications are detailed on Sheet 80 of 210 within the MassDOT - Highway Division Plan & Profile of Bruce Freeman Rail Trail Phase 2A in the Towns of Westford, Carlisle & Acton - 100% Submission; the MassDOT Item 755.7 Specification – Wetland Specialist; and this document.

BVW replication area B = 1,946 sf

Wetland Replication Area B is located west of Sta 223+00 through 224+00. Wetland replication design specifications are detailed on Sheet 81 of 210 within the MassDOT - Highway Division Plan & Profile of Bruce Freeman Rail Trail Phase 2A in the Towns of Westford, Carlisle & Acton - 100% Submission; the MassDOT Item 755.7 Specification – Wetland Specialist; and this document.

Restoration:

BVW restoration Areas - Multiple = 2,310 sf

Table 1: Wetland Resource Area Impacts – Bruce Freeman Rail Trail provided in the Town of Acton Notice of Intent describes the quantity and location of multiple distinct areas of BVW along with Bruce Freeman Rail Trail that will be temporarily impacted and restored in place. The multiple distinct areas range in size from one (1) to 494 square feet. Upon completion of construction activities, the areas will be loamed and seeded with the Wetland Seedmix detailed on Sheets 80 and 81 within the MassDOT - Highway Division Plan & Profile of Bruce Freeman Rail Trail Phase 2A in the Towns of Westford, Carlisle & Acton - 100% Submission; the MassDOT Item 755.7 Specification – Wetland Specialist; and this document.

Mitigation Areas shall be constructed to meet the requirements of permits and certifications including relevant performance standards of the Massachusetts Wetlands Protection Act (MGL C. 131, s40) and U.S. Army Corps of Engineers.

The Contractor shall be responsible for protection and preservation of natural areas adjacent to the Mitigation Areas both within and outside of the project limits for the duration of the contract period. Access to Mitigation Areas shall be clearly defined in order to minimize damage to existing vegetation and soils. The Contractor shall use duck boards or mats, as necessary, to minimize impacts from foot paths or construction equipment. All labor and materials required for protection and preservation of site shall be incidental to this item.

Damage to soils or vegetation due to trampling, vehicles, storing of materials, debris, or negligence shall be repaired to the satisfaction of the Engineer and at the Contractor's expense.

RELATED ITEMS:

The following tasks related to work within the Mitigation Areas shall be paid for under these separate items.

**ITEM 755.7**

**WETLAND SPECIALIST**

The Contractor shall retain a qualified Wetland Specialist as per Item 755.7 WETLAND SPECIALIST to coordinate and oversee work under this item. Work performed by the Wetland Specialist shall be paid for under Item 755.7. The Wetland Specialist shall report directly to the Resident Engineer and work independently of the wetland contractor

**SUBMITTALS:**

Photographic Documentation: Prior to any disturbance, clear and legible digital photographs with date and time stamps shall be taken of the existing site conditions including existing wetlands to be impacted, all proposed wetland mitigation sites and reference/model wetland areas, typically an adjacent undisturbed wetland. These shall be submitted to the Engineer on CD or DVD format.

Contractor shall submit the following for approval by the Engineer in consult with the MassDOT Landscape Architect at least sixty (60) days prior to installation. The Contractor shall be responsible for making all submittals to the Engineer in a timely and complete manner.

Soil and soil amendments: Contractor shall submit for approval all sources of soil and other amendments including compost prior to ordering. Off-site sources shall be identified and available for inspection by the Wetland Specialist prior to transport of material to the site to verify that they are likely to be free of invasive plant species including all viable plant parts.

Plants: Confirmation of availability, source of plant material and certification of provenance from the nursery supplier.

Seed: Source, certification of compliance and certification of provenance from supplier shall be submitted and approved prior to ordering materials.

Compost Filter Tubes: Product literature and samples of all material including compost fill.

**Samples:**

Cut sheets for erosion controls

Sample(s) of soils and soil amendments tested and accepted, if needed.

**MATERIALS**

All materials are incidental to this item unless specified otherwise.

**Erosion Controls:**

Compost Filter Tubes:

Materials shall conform to the requirements of Section 751 and 767 of the Standard Specifications, Plans, and the following:

Fill material for the filter tubes shall be compost meeting M1.06.0, except that no manure or bio-solids shall be used. In addition, no kiln-dried wood or construction debris shall be allowed.

Tubes for compost filters shall be a minimum of 12 inches (300 mm), a maximum of 18" (450mm) in diameter, and shall be jute mesh or approved biodegradable material. Additional tubes may be used at the direction of the Engineer.

As shown in the drawing details, the 1 foot (0.2 meters) wide by 2 inch (50 mm) deep wedge of compost spread along the top of the filter tube shall be incidental to this item.

Stakes for anchors shall be nominal 2" x 2" untreated hardwood stakes.

Planting Soil:

Wetland soil for wetland restoration or replacement may be either soil excavated from impacted wetland area or manufactured hydric soil. If using soil from the impacted wetland area, soil shall not be compacted or grubbed. If the proposed mitigation site is in an area free of invasive species, wetland soil from the impacted wetland that is infested with invasive plant species shall not be used so as to avoid bringing invasive species to a new location. If the mitigation is adjacent to the infested area, wetland soils from the impacted site may be used as they will inevitably spread into the mitigation site. Manufactured wetland soil shall consist of on-site borrow from the proposed replacement site thoroughly mixed with compost to achieve a target organic content of 10-12% by weight. Where empirical data are lacking, compost to soil ratio shall be 1:1 by volume. Off-site borrow may be used for mixing if approved in advance by the Engineer per these Special Provisions.

No soil, compost, or other soil amendment imported to the work site shall contain seeds, roots, stems, or other viable parts of invasive plants. No soil or soil amendment shall be brought on site without prior approval of the material source. Soils used in the replacement area should be free of rocks greater than 4 inches (100 mm) in diameter.

Wetland soils for mitigation area shall be stockpiled outside resource areas and stored at least 100 feet from the edge of the wetland. Precautions shall be taken as necessary to prevent erosion of the stockpiled material. In the event there is excess borrow, it shall be disposed of without additional compensation.

Compost Topsoil:

Compost shall be compost meeting the requirements for Organic Soil Additives, Section M 1.06.0 of the Standard Specifications and the following:

No kiln-dried wood or construction debris shall be allowed.

Organic matter content shall be minimum 30 percent (dry weight basis) as determined by ASTM D2974 (method A) Standard Test Methods for Moisture, Ash and Organic Matter of Peat and Other Organic Soils.

Moisture content shall be 40-60 percent as measured by ASTM D2216 Standard Test Method for Laboratory Determination of Water Content of Soil and Rock and ASTM D2974 (cited above).

Plant Material:

Plants in Mitigation Areas shall conform to SECTION 771 PLANTING TREES, SHRUBS AND GROUND COVER of the Division I Standard Special Provisions and as amended below.

Plant species and sizes shall be as specified on the plans.

All plant material shall be species native to the region. As per current recommendations by the NOAA Restoration Center and the EPA Ecoregion Assessment, in order to maintain genetic diversity, only native species of seed and plants from the EPA Level III Ecoregion of the project area shall be used for ecosystem restoration. The EPA Level III Ecoregions of Massachusetts are Ecoregion 84 Atlantic Coastal Pine Barrens which encompasses Barnstable, Dukes, Nantucket and Plymouth Counties. Ecoregion 59 Northeastern Coastal Zone encompasses the remainder of Massachusetts. The current EPA map, Ecoregions of the Continental United States, is available through the following link: [ftp://ftp.epa.gov/wed/ecoregions/us/Eco\\_Level\\_III\\_US.pdf](ftp://ftp.epa.gov/wed/ecoregions/us/Eco_Level_III_US.pdf)

The nursery source shall certify that the provenance, or origin, of the seed from which the plants were produced is from the applicable EPA Level III Ecoregion.

Transplants and plant material collected from the wild is prohibited unless approved in writing by the MassDOT Landscape Architect and Wetland Specialist. Plant materials shall be selected from certified nurseries that have been inspected by state and/or federal agencies. Nursery inspection certificates shall be furnished to the Engineer upon request.

No plants shall be installed until the Wetland Specialist approves the condition of the plant material and the process of installation.

#### Water:

Plant material shall be saturated with fresh water before delivery, upon delivery to the site and twice daily up to time of installation. The Contractor shall provide water and all equipment required at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plants and wildlife. According to DEP requirements, water from the adjacent water body shall not be utilized. It is the Contractor's responsibility to correct injury or damage due to the lack of water, too much water or use of contaminated water.

Requests for substitutions shall be submitted in writing to the Engineer for review by the MassDOT Landscape Architect at least ninety (90) days prior to planting. The Contractor shall submit a list of nurseries that were contacted and unable to supply the species as shown on the Plans. All proposed substitutes shall be in conformance with the requirements herein and suitable for the site conditions.

#### Seed Mix:

Seed in the Mitigation Areas shall conform the Standard Specifications as amended by the 2010 Standard Special Provisions, SUBSECTION M6, ROADSIDE DEVELOPMENT MATERIALS and as amended herein.

The following seed mix shall be used:

BOTANICAL NAME	COMMON NAME	PERCENTAGE
<i>Carex vulpinoidea</i>	Fox Sedge	25%
<i>Elymus virginicus</i>	Virginia Wildrye	25%
<i>Carex lurida</i>	Lurid (Shallow) Sedge	12%
<i>Carex lupulina</i>	Hop Sedge	6%
<i>Verbena hastata</i>	Blue Vervain	4%
<i>Juncus effuses</i>	Soft Rush	3%
<i>Carex comosa</i>	Cosmos (Bristly) Sedge	3%
<i>Aster umbellatus (Doellingeria umbellata)</i>	Flat Topped White Aster	3%
<i>Aster prenanthoides (Symphyotrichum p.)</i>	Zigzag Aster	3%
<i>Scirpus atrovirens</i>	Green Bulrush	3%
<i>Helenium autumnale</i>	Common sneezeweed	2%
<i>Zizia aurea</i>	Golden Alexanders	2%
<i>Ludwigia alternifolia</i>	Seedbox	2%
<i>Lobelia siphilitica</i>	Great Blue Lobelia	1%
<i>Aster puniceus (Symphyotrichum puniceum)</i>	Purplestem Aster	1%
<i>Vernonia gigantea (V. altissima)</i>	Giant Ironweed	1%
<i>Scirpus cyperinus</i>	Woolgrass	1%
<i>Eupatorium perfoliatum</i>	Boneset	1%
<i>Euthamia graminifolia (Solidago g.)</i>	Grassleaf Goldenrod	1%
<i>Asclepias incarnata</i>	Swamp Milkweed	1%
	Total:	100%

Seeding rate shall be 20 lbs. per acre or 0.5 lbs. per 1,000 square feet. All species shall be of a local ecotype meeting the EPA Level III Ecoregion requirements as described in the Plant Materials section.

## METHODS

### Site Preparation:

Prior to an initial site meeting, the Contractor shall stake out Mitigation Area boundaries and set grade stakes in the field. Prior to start of work, the Contractor shall walk the site with the Engineer, Wetland Specialist, and MassDOT Landscape Architect for an initial site meeting. The purpose of the meeting is to verify limits of work, locations and installation of Phase 1 erosion controls, proposed construction methods, and grade stake elevations.

### Erosion and Sediment Control:

The Contractor shall plan and execute operations in a manner minimizing the amount of excavated and exposed fill or other foreign materials that could be washed or otherwise carried into Mitigation Areas and nearby wetland resource areas. The Engineer and Wetland Specialist shall inspect and approve erosion and sediment control measures prior to excavation work. Erosion controls shall be in place prior to any construction activities.

Compost Filter Tubes shall serve as temporary erosion control during construction until establishment of erosion control seeding. Compost Filter Tubes shall also act as a limit of work barrier.

Where restoration requires planting in existing grade to fill in among existing vegetation, disturbance to existing soils will be minimal and erosion controls may not be necessary around these restoration planting areas.

Erosion controls shall be installed along the downslope perimeter of Mitigation Areas beginning and ending in the surrounding upland so that no excavated material or disturbed soil can enter adjacent wetlands or waters.

The Contractor shall remove sediment deposits as necessary to maintain the filters in working condition. The Contractor shall maintain erosion controls in a functional condition at all times, including inspections after each rainfall and at least daily during prolonged rainfall and shall immediately correct all deficiencies including replacing compost filter tubes as needed.

Upon final acceptance of seeding, the compost filter tubes shall be cut open, compost spread evenly over the soil surface a maximum depth of 2-inches and the composted area shall be seeded with same seed mix used in the surrounding area. Stakes, ropes and other non-biodegradable materials shall be removed and disposed of offsite by the Contractor. Existing vegetation disturbed by erosion control installation and removals shall be replanted as directed by the Engineer.

#### Excavation and Grading:

Final grades in the Mitigation Areas shall conform to target elevations as shown on the Plans and as approved by the Wetland Specialist. Restoration areas shall conform to existing and/or adjacent grades.

Mitigation Areas shall be staked and grades set for approval by the Wetland Specialist prior to excavation. To the extent possible, limits shall be a minimum of 6 feet from trunk of trees. Actual limits of mitigation areas may be adjusted in the field to protect root systems of existing trees. However, the total area of Wetland Mitigation required by all permits shall not be reduced.

Mitigation area shall be covered with 2-inch layer of Compost Topsoil to provide compost mulch for erosion control and better seed establishment. Typically, hydraulic application equipment will be required for this item, unless otherwise permitted by the Engineer, in writing.

Note: to avoid compaction, once soil has been placed, no heavy equipment shall travel across placed soil. Do not work with wet or moist soils. Work that results in compaction of soils shall result in replacement of wetland soils at no additional cost to the contract.

It is the Contractor's responsibility to identify existing areas of established invasive plants and notify the Engineer and Wetland Specialist of the condition. Soil containing invasive plant material shall be excavated and disposed of off-site at an approved facility.

All cut trees, stumps, brush, wrack or vegetation not specified to remain shall be removed from Mitigation Areas unless directed otherwise by the Engineer. Materials shall not to be stockpiled in the resource areas or buffer zone while awaiting disposal.

Sequence and execution of work shall ensure minimal compaction and heavy equipment moving over placed planting soil. If heavy equipment is required to travel over existing wetland soils, wood mats shall be placed to minimize impacts. Upon acceptance of final grades, no heavy equipment shall travel across mitigation areas or adjacent wetland resource areas.

The finished grade shall be at an elevation that will provide a hydrologic connection between the replacement area and adjacent resource areas. The hydrologic connection should be in keeping with restoring the intended function of the replacement wetland. The Contractor shall verify that this elevation is not at a level that could alter the hydrology of an adjacent wetland.

Mitigation Area Planting:

Planting in Mitigation Areas shall conform to SECTION 771 PLANTING TREES, SHRUBS AND GROUND COVER of the Division I Standard Special Provisions and as amended below.

Planting shall be overseen by the Wetland Specialist. Mitigation Areas shall be planted in the dry and according to the planting details within the range of target elevations and at the spacing shown on the Plans. If Mitigation Area includes more than one planting zone, the Wetland Specialist shall flag out limits prior to planting. Plants shall be installed. Discrepancies shall be resolved by the Engineer in consultation with the Wetland Specialist and MassDOT Landscape Design Section.

Plant material shall be installed as soon as possible after delivery. Plants stored on-site prior to installation shall be maintained in acceptable condition as described in materials section. Plants showing signs of stress or compromised health may be rejected by the Engineer or Wetland Specialist with replacement at the Contractor's expense.

Mitigation Performance Standards:

The Contractor shall fulfill the following minimum Mitigation Performance Standards for the Mitigation Areas within a Planting Guarantee Period of two (2) full growing seasons. Monitoring shall be performed by the Wetland Specialist according to Item 755.7 WETLAND SPECIALIST.

1. The target elevations for Mitigation Areas and planting types have been met and maintained. A minimum of 90 percent of each wetland mitigation area must meet desired hydrology. Areas that are too high or too low should be identified along with suggested corrective measures.
2. Establish at least 80 percent uniform cover of the intended herbaceous wetland plant community.
3. Establish at least 95 percent of woody plants installed.

Plant species listed as invasive by Massachusetts Invasive Plant Advisory Group (MIPAG) and the USACE – New England District shall be identified as such in the monitoring reports and corrective measures taken to control them within the limits of the Mitigation Areas for the duration of the Planting Guarantee Period.



If at the end of the Planting Guarantee Period, the Mitigation Performance Standards have not been met according to the monitoring report, the Contractor shall provide corrective measures and install replacement plant material to achieve the required establishment. All costs associated with achieving the Mitigation Performance Standards through the Planting Guarantee Period shall be incidental to this item.

#### As-Built Drawings:

Following acceptance of the planting by MassDOT, as-built drawings of the Wetland Mitigation Areas shall be surveyed and prepared by the Contractor for use by the Wetland Specialist as per the USACE - New England District's Compensatory Mitigation Guidance. As-built drawings shall be prepared at a clearly legible scale including 1-ft. contours and polygons outlining each wetland mitigation area. The as-built drawings shall serve to confirm that area requirements have been met and as the base map for mitigation monitoring. The as-built drawings shall be provided in printed paper format (full size 24" x 36" sheets, unless otherwise directed) as well as Portable Document Format (e.g., Adobe PDF) and AutoCAD files on compact disk. As-built drawings shall be completed within 30 days of acceptance of initial wetland mitigation planting.

#### Monitoring and Maintenance:

Monitoring shall be performed by the Wetland Specialist in order to ensure compliance with the Mitigation Performance Standards. Monitoring methods and report content shall conform to the Wetland Mitigation Report as approved by the regulatory agencies. The monitoring schedule shall be as per Item 755.7 WETLAND SPECIALIST. Work performed by the Wetland Specialist shall be according to and paid for under Item 755.7 WETLAND SPECIALIST.

Based on monitoring results and as directed by the Engineer in consult with the MassDOT Landscape Design Section, the Contractor shall make corrective measures to achieve compliance with the Mitigation Performance Standards. All plants not showing satisfactory evidence of establishment during the Planting Guarantee Period shall be replaced within the appropriate planting window. Unsatisfactory plants shall be removed and replaced along with dead and missing plants. All maintenance shall be incidental to this item.

#### COMPENSATION

Non-tidal wetland mitigation areas will be measured for payment by square yard, installed, approved and maintained in place.

Within 10 days of the award of the contract, the Contractor shall submit, in duplicate, for approval by the Engineer, a schedule of quantities and unit prices for the major components of the Mitigation Areas as listed on the following table. The cost of labor and materials for any item not listed but required to complete the work under this item shall be considered incidental to the item and no further compensation will be allowed.

Item Component	Quantity	Unit	Unit Price	Amount	Notes
	BVW				
Compost Filter Tubes	455	FT			
Compost Topsoil	45	CY			assumes 4" depth
Bordering Vegetated Wetland Seeding	385	SY			
Red maple ( <i>Acer rubrum</i> ) plant height, container size	20	EA			
Highbush Blueberry ( <i>Vaccinium Corymbosum</i> )	17	EA			
Swamp azalea ( <i>Rhododendron viscosum</i> )	8	EA			
Winterberry ( <i>Ilex verticillata</i> )	9	EA			
Cinnamon fern ( <i>Osmunda cinnamomea</i> )	24	EA			
Royal Fern ( <i>Osmunda regalis</i> )	9	EA			
Sensitive Fern ( <i>Onoclea sensibilis</i> )	15	EA			

Work for Item 755.3 NON-TIDAL WETLAND MITIGATION AREAS shall be measured and paid at the contract bid price per lump sum, which price shall include full compensation for work herein.

Such payment shall be considered full compensation for all labor, tools, equipment, materials, travel and incidentals necessary to complete the work as described herein and in a manner satisfactory to the Engineer.

#### PAYMENT SCHEDULE

75 percent paid upon acceptance of initial planting

25 percent paid at end of second growing season.

**ITEM 755.7****WETLAND SPECIALIST****HOUR**

The Contractor shall retain the services of a Coastal Ecologist, Wetland Scientist, Wetland Ecologist, Restoration Ecologist, or other professional with similar qualifications hereafter referred to as the Wetland Specialist. The Wetland Specialist shall possess the knowledge and expertise to coordinate and oversee all work associated with wetland replication as defined herein, as shown on the Plans and as in Item 755.3 NON-TIDAL WETLAND MITIGATION.

The Wetland Specialist shall serve as an expert advisor to the Engineer and report directly to the Resident Engineer.

**QUALIFICATIONS**

The Wetland Specialist shall have a minimum of five (5) years' experience in successful construction and monitoring of wetland mitigation areas that is similar to the project. The Wetland Specialist shall be thoroughly versed in the Commonwealth of Massachusetts Wetlands Protection Act (MGL C.131, s.40); U.S. Army Corps of Engineers New England District Compensatory Mitigation Guidance; and all other relevant regulations of the Massachusetts Department of Environmental Protection and the U.S. Army Corps of Engineers - New England District.

**SUBMITTALS**

Within sixty (60) days following the Notice to Proceed, the Contractor shall furnish proof of qualifications for the Wetland Specialist to the Engineer for approval in consult with the MassDOT Landscape Architect.

Proof of qualifications shall include, but not be limited to, the following items:

- a. Narrative describing company, its expertise, technical qualifications and experience with wetland construction.
- b. Resumes of individuals who will perform the work, if different from company description.
- c. At least three (3) references from prior work of a similar nature that was completed in last five (5) years by the individuals who will perform the work. Provide contact information for each reference including address, phone number and email.
- d. Provide a summary of each of reference project including nature of the work, project size, dates and period of construction and monitoring, methodologies used, and summary of success or not in terms of meeting performance objectives.
- e. Provide a minimum of one before and one after photo for each reference project.
- f. Provide a minimum of one complete set of monitoring reports for a similar project including a Final Assessment Report as per the U.S. Army Corps of Engineers New England District Compensatory Mitigation Guidance.

## SCOPE OF WORK

The Wetland Specialist shall be responsible for oversight and monitoring of work associated with Item 755.3 NON-TIDAL WETLAND MITIGATION including, but not limited to, the following tasks:

- Review environmental permits relevant to wetland replication and ensure compliance through the duration of the contract.
- Evaluate site and conditions prior to construction. Identify and inform the Engineer of unique site conditions that could require adjustments to the schedule, design or construction methods. For example, wildlife nesting, illegal dumping or presence of invasive plant species.
- Review suitability of material submittals prior to submission to the Engineer with copies to MassDOT Landscape Architect.
- Participate in site meetings as outlined in Item 755.3 NON-TIDAL WETLAND MITIGATION.
- Review erosion controls (within the Mitigation Areas only), monitor construction impacts to adjacent areas and regulated wetland resources.
- Provide updates at project milestones according to Item 755.3 NON-TIDAL WETLAND MITIGATION.
- Perform digital photo documentation through the duration of the contract and submit a photo archive on compact disk upon completion.
- Perform site observations at least two times during the growing season in late spring/early summer and again in late summer/early fall.
- Submit annual monitoring reports in the format provided in the US Army Corps of Engineers - New England District: Compensatory Mitigation Guidance.
- Make written recommendations on maintenance and corrective measures following each site observation in order to achieve the Mitigation Performance Standards.

The Wetland Specialist shall be responsible for oversight and approval of, including but not limited to, the following activities in coordination with the Contractor and Engineer.

- Location and boundaries of wetland replication area, location of tree protection associated with the wetland replication areas, limits of clearing and limits of work in the replication areas
- Installation and removal of erosion controls
- Target elevations and grade stakes prior to excavation
- Final grades prior to planting and/or seeding
- Flagging wetland plant locations prior to installation
- Planting installation and/or seeding procedures.
- Removal of perimeter controls, such as goose fence

Monitoring reports shall be submitted no later than November 1 of each monitoring period. For each project update and monitoring report, submit one (1) printed copy and a digital copy in Portable Document Format (e.g., Adobe PDF) to the Engineer for distribution to the MassDOT Landscape Architect, MassDOT Environmental Services, U.S. Army Corps of Engineers, National Marine Fisheries Service (Habitat Conservation) and the US Environmental Protection Agency. All reports shall be marked with the applicable permit numbers and identifying information as required in the permits.

Monitoring:

Monitoring will be performed for the wetland replication areas in order to ensure satisfactory plant establishment and compliance with the Mitigation Performance Standards as defined in Item 755.3 NON-TIDAL WETLAND MITIGATION and as defined in the Wetland Mitigation Report approved by the US Army Corps of Engineers.

Plant species listed as invasive by Massachusetts Invasive Plant Advisory Group (MIPAG) and the USACE – New England District shall be identified as such in the monitoring reports and corrective measures taken to control them within the limits of the wetland mitigation areas for the duration of the contract. The definition of invasive plant species referred to herein shall be as defined by Massachusetts Invasive Plant Advisory Group (MIPAG) and classified as Invasive, Likely Invasive or Potentially Invasive according to their current classification lists. MIPAG link: <http://www.massnrc.org/MIPAG/>

Invasive plant species shall also include those listed by the USACE New England District.

As per the monitoring schedule, the Wetland Specialist shall complete and submit a monitoring report detailing the relative success of the replication areas and make recommendations for maintenance and/or corrective measures. According to the USACE permit conditions, a growing season starts no later than May 31. Reports shall include data sheets. Data summaries shall be cumulative in each successive report.

Monitoring report requirements shall be as outlined in the USACE New England District Compensatory Mitigation Guidance and include the following.

- Identification of all plant species present
- Quantity installed and total mortality of each target plant species
- Percent cover for each plant species and overall percent cover for replication area
- Description of health and vigor of installed target species as well as volunteer plant species within the replication areas
- Changes in site conditions including topography, such as erosion, gullies, shifting or accretion of sediment, and hydrology, such as ponding, damming, breaches or other observed changes in water levels
- Condition of perimeter controls (such as goose fence) and erosion controls
- Evidence of pests, disease and invasive plant species
- If invasive plant species are identified in replication areas, measure and map approximate area of establishment for each species
- Photo documentation with date and time stamped photos
- Visual observations of fauna using or in the vicinity of the site at the time of monitoring
- Any other information required by permits, Massachusetts DEP and U.S. Army Corps of Engineers regulations and requirements.

Monitoring Report & Schedule:

## 1. End of First Growing Season

At the end of the first full growing season before plants enter dormancy, typically in September, inspect to document the monitoring parameters defined above.

## 2. End of Second Growing Season

At the end of the second growing season before plants enter dormancy, typically in September, inspect to document the monitoring parameters defined above.

Monitoring Report Appendices:

Appendix A: Soil profile description shall be provided from within wetland mitigation areas.

Appendix B: A vegetative species list of colonizing species in each plant community type. The volunteer species list shall include those that cover at least 5% of their vegetative layer.

Appendix C: Representative photos taken from the same locations for each monitoring event. Photos shall be dated and clearly labeled with the direction from which the photo was taken.

Maintenance Requirements:

Wetland replication shall show satisfactory establishment as defined according the Mitigation Performance Standards in Item 755.3 NON-TIDAL WETLAND MITIGATION. The Contractor shall be responsible for maintenance and replacement according to those items. Corrective measures requiring earth movement or changes in hydrology shall not be implemented without written approval from the Corps to MassDOT.

Maintenance of wetland mitigation areas shall include replacement of dead or missing plant material, maintaining goose fence in effective and satisfactory condition, maintaining compost filter tubes in functioning condition, removal of debris within and around perimeter of mitigation area, correcting erosion or gullies.

Based on monitoring results, plants that have not shown satisfactory evidence of establishment shall be replaced and corrective measures taken. Dead or missing plants shall be replaced within the next appropriate planting window.

If at the end of the second growing season and upon acceptance of the monitoring report, the Mitigation Performance Standards have not been met and the Contractor is required to perform corrective measures, the Wetland Specialist shall be compensated for work ordered.

The permits require a total of five-years monitoring of mitigation areas. MassDOT shall be responsible for fulfilling the permitting requirements beyond the end of the second growing season. The post-construction Final Wetland Assessment monitoring report to be submitted to the applicable regulatory agencies at the end of the fifth growing season is not included in the scope of this item.

## COMPENSATION

The work described under this item shall be measured per HOUR. The basis for measurement is as follows:

1. Permit Review\ Site Assessment\Construction Oversight - 40 HRS
2. 1<sup>st</sup> year Spring and Fall field observation\Spring Update\Monitoring Report - 16 Hours
3. 2<sup>nd</sup> year Spring and Fall field observations\Spring Update\ Monitoring Report – 16 hours

The work described under this item shall be measured and paid at the contract unit price per HOUR, which price shall include labor, tools, equipment, materials, travel and incidentals necessary to complete the work as described herein and in a manner satisfactory to the Engineer.

### ITEM 756.

### NPDES STORMWATER POLLUTION PREVENTION PLAN

### LUMP SUM

(Rev. 09/2009)

This Item addresses the preparation and implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit.

Pursuant to the Federal Clean Water Act, construction activities which disturb one acre or more are required to apply to the U.S. Environmental Protection Agency (EPA) for coverage under the NPDES General Permit for Storm Water Discharges From Construction Activities. On July 14, 2008 (73 FR 40338), EPA issued the final NPDES Construction General Permit (CGP) for construction activity.

The NPDES CGP requires the submission of a Notice of Intent (NOI) to the U.S. EPA prior to the start of construction (defined as any activity which disturbs land, including clearing and grubbing). There is a seven (7) day review period commencing from the date on which EPA enters the Notice into their database. The Contractor is advised that, based on the review of the NOI, EPA may require additional information, including but not limited to, the submission of the Storm Water Pollution Prevention Plan for review. Work may not commence on the project until final authorization has been granted by EPA. Any additional time required by EPA for review of submittals will not constitute a basis for claim of delay.

In addition, if the project discharges to an Outstanding Resource Water, vernal pool, or is within a coastal ACEC as identified by the Massachusetts Department of Environmental Protection (DEP), a separate notification to DEP is required. DEP may also require submission of the Storm Water Pollution Prevention Plan for review and approval. Filing fees associated with the notification to DEP and, if required, the SWPPP filing to DEP shall be paid by the Contractor.

The General Permit also requires the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the afore-mentioned statutes and regulations. The Plan will include the General Permit conditions and detailed descriptions of controls of erosion and sedimentation to be implemented during construction. It is the responsibility of the Contractor to prepare the SWPPP to meet the requirements of the most recently issued CGP.

The Contractor shall submit the Plan to the Engineer for approval at least four weeks prior to any site activities. It is the responsibility of the Contractor to be familiar with the General Permit conditions and the conditions of any state Wetlands Protection Act Order, Water Quality Certification, Corps of Engineers Section 404 Permit and other environmental permits applicable to this project and to include in the Stormwater Pollution Prevention Plan the methods and means necessary to comply with applicable conditions of said permits.

It is the responsibility of the Contractor to complete the SWPPP in accordance with the EPA Construction General Permit, provide all information required, and obtain any and all certifications as required by the Construction General Permit. Any amendments to the SWPPP required by site conditions, schedule changes, revised work, construction methodologies, and the like are the responsibility of the Contractor. Amendments will require the approval of the Engineer prior to implementation.

Included in the General Permit conditions is the requirement for inspection of all erosion controls and site conditions on a weekly basis as well as after each incidence of rainfall exceeding 0.5 inches in twenty-four hours. The Contractor shall choose a qualified individual who will be onsite during construction to perform these inspections. The Engineer must approve the contractor's inspector. In addition, if the Engineer determines at any time that the inspector's performance is inadequate, the Contractor shall provide an alternate inspector. Written weekly inspection forms, storm event inspection forms, and Monthly Summary Reports must be completed and provided to the Engineer. Monthly Summary Reports must include a summary of construction activities undertaken during the reporting period, general site conditions, erosion control maintenance and corrective actions taken, the anticipated schedule of construction activities for the next reporting period, any SWPPP amendments, and representative photographs.

The Contractor is responsible for preparation of the Plan, all SWPPP certifications, inspections, reports and any and all corrective actions necessary to comply with the provisions of the General Permit. Work associated with performance of inspections is not included under this Item. The Standard Specifications require adequate erosion control for the duration of the Contract. Inspection of these controls is considered incidental to the applicable items. This Item addresses acceptable completion of the SWPPP, any revisions/amendments required during construction, and preparation of monthly reports. In addition, any erosion controls beyond those specified in bid items elsewhere in this contract which are selected by the Contractor to facilitate and/or address the Contractor's schedule, methods and prosecution of the work shall be considered incidental to this item.

The CGP requires the submission of a Notice of Termination (NOT) from all operators when final stabilization has been achieved. Approval of final stabilization by the Engineer and confirmation of submission of the NOT will be required prior to submission of the Resident Engineer's Final Estimate.

### COMPENSATION

Payment for all work under this Item shall be made at the contract unit price, lump sum, which shall include all work detailed above, including Plan preparation, required revisions, revisions/addenda during construction, monthly reports and filing fees.



Payment of fifty (50) % of the contract price shall be made upon acceptance of the Stormwater Pollution Prevention plan. Payment of forty (40) % of the contract price shall be made in equal installments for implementation of the Stormwater Pollution Prevention plan. Payment of the final ten (10) % of the contract price shall be paid upon satisfactory submissions of a Notice of termination (NOT) when final stabilization has been achieved.

**ITEM 765.15****SEEDING – STEEP SLOPE MIX****SQUARE YARD**

The work under this item shall conform to the applicable requirements of Section 765 of the Standard Specifications, except as amended and supplemented as indicated on the drawings and as specified below.

**DESCRIPTION**

The work of this Section consists of all seeding work and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

- A. Incorporation of Additives for Seeding
- B. Fine Grading
- C. Mechanical Seeding
- D. Hydroseeding
- E. Hydromulching
- F. Maintenance and protection

All seeding work shall be done by a firm experienced in seeding work having a minimum of five years experience with seeding installation. Prior to beginning work, the Contractor shall furnish proof of qualifications to the Engineer for approval.

Hydromulch installation work shall include the installation of wood fiber mulch, as shown on the Drawings or as indicated in the specifications, herein. Hydromulch shall be installed on areas within the project limits. Matting for Erosion Control shall be used on all areas seeded with the same mixes on all slopes that are steeper than one vertical foot to three horizontal feet within the project limit as specified under Item 767.9, MATTING FOR EROSION CONTROL.

The work of this Section includes topdressing and overseeding the existing or grass cover or repairing grass damaged by construction and as shown in the Drawings and as directed. Steep Slope Mix (low growing turf type fescues) is for use on long, steep slopes under heavy plantings where mowing will be difficult and erosion can occur. Application of this mix shall be as shown on the Drawings and as directed.

### Samples and Submittals

At least 60 days prior to ordering, the Contractor shall submit to the Engineer material specifications and (where applicable) installation instructions attesting that the following materials meet the requirements specified. No material shall be ordered until submittals have been approved by the Engineer. Delivered materials shall match approved materials.

- A. Seed
- B. Fertilizer
- C. Ground limestone
- D. Superphosphate
- E. Hydromulch

Seed: A manufacturer's Certificate of Compliance shall be submitted with each shipment of seed. These Certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. Only current year's crop seed shall be permitted. No seed may be sown until the Contractor has submitted the Certificates of Compliance.

Hydroseed and Hydromulch: Prior to the start of work, the Engineer shall be furnished with a certified statement for approval as to the number of pounds of seed, mulch and tackifier to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding or hydromulching that can be covered with the quantity of solution in the hydroseeder.

### MATERIALS

Seed Section M6.03.0 shall be amended as follows.

The following seed mix, conforming in plant species to the percentages specified, shall be used in areas as indicted on the drawings.

Supply 3 Lbs/1000 SF of the following Seed for ITEM 765.15, SEEDING-STEEP SLOPE MIX (for planting in shrub beds on steep slopes).

#### Grass Mixture:

Name	Germination	Purity	Lbs/1000sf
Festuca longifolia "Reliant" Reliant Hard Fescue	96%	85%	1.05
Festuca longifolia "Crystal" Crystal Hard Fescue	96%	85%	1.05
Festuca var. Commutata "Jamestown" Jamestown Fescue	80%	85%	0.75
Trefolium repens White Clover	75%	85%	0.15
		Total:	3.0 Lbs.

Seed shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. Where possible, seed stock shall come from a local source. The seed shall be furnished and delivered, in the proportion specified, in new, clean, sealed, and properly labeled containers. All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed which has become wet, moldy or otherwise damaged shall not be acceptable. The Contractor shall take care to handle and store the wildflower seed according to grower's recommendations and shall not subject the seed to extremes of heat, cold or moist conditions.

Refer to the Drawings for limits and types of seeding required and as directed by the Engineer.

Fertilizer Section M6.02.0 shall be supplemented by the following:

Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers which shall bear the manufacturer's certificate of compliance covering analysis. At least 50% by weight of the nitrogen content shall be derived from organic materials. Fertilizer shall contain not less than the percentages of weight of ingredients as follows or as recommended by the soil analysis:

Nitrogen  
10%

Phosphorus  
6%

Potash  
4%

Limestone Section M6.01.0 shall be amended so that dolomitic limestone shall be the only acceptable form.

Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 18% available phosphoric acid.

Water, including hose and all other watering equipment required for the work, shall be furnished by the Contractor to the site at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plant life. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct.

Hydromulch to cover hydroseeded areas shall be fiber processed from whole wood chips manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper or cardboard.

Moisture content of hydromulch shall not exceed 10%, plus or minus 3% as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than not less than 2 pounds water per ¼ pound fiber.

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The hydromulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.

The hydromulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be noninjurious to plant growth.

## CONSTRUCTION

### Inspections

Soil amendments, such as fertilizer, lime, and organic material, shall be based on tests of representative samples of compost topsoil to be used on the slopes. Contractor shall be responsible for ensuring timely testing and recommendations. Soil tests shall be by a laboratory acceptable to the Engineer. Soil test results and recommendations shall be delivered to the Engineer.

Notify the Engineer and arrange for inspections of areas to be seeded when:

- A. When planting soil (compost topsoil) has been spread and fine graded, amendments incorporated and before seeding.
- B. When seeding operations are beginning.
- C. When seeding operations are complete to establish a date when maintenance shall commence. When maintenance period is complete for Acceptance.

Notify the Engineer and arrange for inspections of areas to be top dressed and overseeded when:

- A. Existing grass areas have been mown to the required heights.
- B. When top dressing compost topsoil has been spread prior to seeding.
- C. When overseeding is complete to establish a date when Maintenance shall commence.
- D. When maintenance period is complete for Acceptance.

### General Construction Methods

Placement of Compost Topsoil shall be installed and paid for under Item 751.7.

The season for seeding work shall typically be from April 1 to June 1 and from August 15 to October 15 with the following qualifications. The actual turf construction work shall be done only during periods within the season which are normal for such work as determined by weather conditions and by accepted practice in this locality and as accepted by the Engineer.

Seed only when the bed is in a friable condition, not muddy or hard. Areas where the soil condition is unacceptable may be required to be replaced and/or reworked and amended until acceptable to the Engineer at no additional cost to the Department.

Install erosion control matting in all drainage swales and on all slopes steeper than one vertical foot to three feet horizontal, per Item 767.9, **MATting FOR Erosion Control**.

### Incorporation of Additives

Soil additives shall be spread and thoroughly incorporated into the top four (4) inches of the compost topsoil layer by harrowing or other methods approved by the Engineer.

### Fine Grading of Seeded Areas and Preparation of the Seed Bed

The whole surface shall then be fine graded by hand raking. Remove large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Remove all stones over one (1) inch in diameter from the top three (3) inches of the compost topsoil. Compost topsoil shall also be free of smaller stones in excessive quantities as determined by the Engineer.

If seed bed is proposed to be seeded by hand broadcasting, smooth surface to meet finished grades with raking and broadcast seed according to requirements specified. Compact with rolling after seeding. If bed is proposed to be hydroseeded, roll and compact bed before seeding. The surface shall then be compacted with a roller or other suitable means to remove air pockets and achieve an even stable surface that is sufficiently porous to absorb water and allow root growth. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional borrow and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

#### Turf Construction

Contractor shall obtain Engineer's written approval of fine grading and bed preparation before doing any seeding or hydroseeding.

#### Seeding

Seeding shall be scheduled when rain is not expected for 48 hours and within seasonal dates specified. No seeding shall be done in windy or wet weather. Prepared compost topsoil bed shall be reviewed by the Engineer before seeding commences.

#### Hand Seeding

For hand seeding rake soil lightly and roll to ensure seed is in firm contact with soil. Following rolling, water the seeded area thoroughly and evenly with a fine spray to penetrate the soil to a depth of at least two (2) inches.

Seeding shall be done in two directions at right angles to each other. Sow the seed with seeding device at the specified seeding rate as accepted by the Engineer.

#### Hydroseeding

For hydroseeding, a mobile tank with a capacity of at least 500 gallons shall be filled with water and seed in quantities so they may be sprayed in the specified proportions per unit of area to be hydroseeded.

The slurry shall be thoroughly mixed by means of positive agitation in the tank. The slurry shall be applied by means of a centrifugal pump using the turret or hose application technique from the mobile tank. The hose or turret shall be equipped with a nozzle of a proper design to insure even distribution of the hydroseeding slurry over the area to be hydroseeded. The hose or turret shall be operated by a person thoroughly familiar with this type of seeding operation.

#### Seeding

Differing quantities of hydromulch, fertilizer, superphosphate, and limestone shall be included in slurry mix depending on seed type, application requirements, and recommendations for amendments based on results of compost topsoil soil analysis.

#### Seeding for Steep Slopes

For slopes steeper than 3:1, erosion control matting shall be installed and paid for as specified in Item 767.9., Matting for Erosion Control.

### Preparing and Top Dressing of Areas to be Overseeded

All areas of existing or damaged grass areas shall be top dressed and overseeded as directed by the Engineer. Mow existing grass to a height of four (4) inches before topdressing and overseeding. Remove and discard all grass clippings and debris from the site.

Contractor shall spread approved, mechanically screened compost topsoil in areas of top dressing in accordance with Item 751.7, Compost Topsoil.

### Overseeding

Contractor shall obtain Engineer's written approval of top dressing of screened compost topsoil before doing any seeding.

Seed only when the top-dressed bed is in a friable condition, not muddy or hard.

Seed type and application rates for overseeding shall be the same as those listed in application rates for the particular seed mix specified for that area in locations as shown on the Drawings.

To maximize seed to soil contact, slice seeding is recommended for all areas to be overseeded. Mechanical seeding shall be undertaken in two separate passes at ninety degrees to each other. Rake soil lightly and roll to ensure seed is in firm contact with soil.

Following rolling, thoroughly and evenly water seeded areas with a fine spray to penetrate the top-dressed screened compost topsoil to a depth of at least four (4) inches.

### Turf Maintenance

Maintenance shall begin immediately after any area is seeded and shall continue for a minimum 60-day active growing period following the completion of all turf construction work, and until final acceptance of the project. In the event that seeding operations are completed too late in the fall for adequate germination and growth of grass, then maintenance shall continue into the following spring and reseeding shall take place as necessary at that time. Adequate growth shall be as determined by the Engineer.

Maintenance shall include reseeding, erosion control, watering, weeding, fertilizing, and resetting and straightening of protective barriers. Herbaceous and woody weeds shall be removed from seeded areas.

Watering shall be provided as follows:

- A. The Contractor shall provide all labor and water required to establish all seed mixes, turf and wildflowers. Contractor shall water as required, during maintenance period to insure that one (1) inch of water is applied in the soil to the seeded areas and that water is maintained to a depth of two (2) inches or greater.
- B. Watering shall be done in a manner which will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply one complete coverage to the grass areas in an 8 hour period.

After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Engineer, fail to show a uniform stand of turf, for any reason whatsoever, shall be repaired, regarded as necessary until all areas are stable and covered with a satisfactory growth of turf. Repair and reseeding shall occur within specified seeding dates, and may require repeated applications of seed and fertilizer. All such repairs and reseeding shall be done by a method approved by the Engineer and shall be incidental to this item.

During the maintenance period, any decline in the condition of seeded areas shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall, at his own expense, engage professional horticulturists to inspect turf and to identify problems and recommend corrective procedures.

A satisfactory stand of turf, as determined by the Engineer, shall be required to be acceptable. Seeded areas shall have a close stand of grass with no weeds present and no bare spots greater than three (3) inches in diameter. All surfaces of the soil shall be stable and at least 90 percent of the grass established shall be permanent grass species. At the time of acceptance, the Contractor shall remove temporary barriers used to protect turf areas. Absolutely no debris may be left on the site.

### COMPENSATION

Seeding Steep Slope Mix will be measured per for payment by the square yard, complete in place.

Seeding Steep Slope Mix will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for all fine grading, amendments, seeding, maintenance, mowing and watering, but all costs in connection therewith shall be included in the Contract unit price bid.

Placement and grading of compost topsoil will be paid for separately under Compost Topsoil, Item 751.7. Matting for erosion control will be paid for separately under Matting for Erosion Control, Item 767.9.

**ITEM 765.4****NHESP RESTORATION AREA SEED MIX****SQUARE YARD**

The work under this item shall conform to the applicable requirements of Section 765 of the Standard Specifications, except as amended and supplemented as indicated on the drawings and as specified below.

**DESCRIPTION**

The work of this Section consists of all seeding work and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

- A. Incorporation of Additives for Seeding
- B. Fine Grading
- C. Mechanical Seeding
- D. Hydroseeding
- E. Hydromulching
- F. Maintenance and protection

All seeding work shall be done by a firm experienced in seeding work having a minimum of five years experience with seeding installation. Prior to beginning work, the Contractor shall furnish proof of qualifications to the Engineer for approval.

Hydromulch installation work shall include the installation of wood fiber mulch, as shown on the Drawings or as indicated in the specifications, herein. Hydromulch shall be installed on areas within the project limits. Matting for Erosion Control shall be used on all areas seeded with the same mixes on all slopes that are steeper than one vertical foot to three horizontal feet within the project limit as specified under Item 767.9, MATTING FOR EROSION CONTROL.

The work of this Section includes topdressing and overseeding the existing or grass cover or repairing grass damaged by construction and as shown in the Drawings and as directed. NHESP has identified three priority habitat focus areas within the project limits. NHESP Restoration Area Seed Mix is to be used in the three focus areas. Focus Area 1 is located from Station 143+50 to 602+00. Focus Area 2 is located from Station 188+50 to 195+00 and 203+00 to 225+00. Focus Area 3 is located from Station 55+75 to 68+00. Application of this mix shall be as shown on the Drawings and as directed.

**Samples and Submittals**

At least 60 days prior to ordering, the Contractor shall submit to the Engineer material specifications and (where applicable) installation instructions attesting that the following materials meet the requirements specified. No material shall be ordered until submittals have been approved by the Engineer. Delivered materials shall match approved materials.

- A. Seed
- B. Fertilizer
- C. Ground limestone
- D. Superphosphate
- E. Hydromulch



Seed: A manufacturer's Certificate of Compliance shall be submitted with each shipment of seed. These Certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. Only current year's crop seed shall be permitted. No seed may be sown until the Contractor has submitted the Certificates of Compliance.

Hydroseed and Hydromulch: Prior to the start of work, the Engineer shall be furnished with a certified statement for approval as to the number of pounds of seed, mulch and tackifier to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding or hydromulching that can be covered with the quantity of solution in the hydroseeder.

## MATERIALS

Seed Section M6.03.0 shall be amended as follows.

The following seed mix, conforming in plant species to the percentages specified, shall be used in areas as indicted on the drawings.

Supply 3 Lbs/1000 SF of the following Seed for ITEM 765.4, NHESP Restoration Area Seed Mix.

Eastern Ecotype Native Grass Mix		
Botanical Name	Common Name	Percentage
<i>Andropogon gerardii</i>	Big Bluestem	60%
<i>Panicum virgatum</i>	Switchgrass	20%
<i>Elymus virginicus</i>	Virginia wildrye	16%
<i>Agrostis perennans</i>	Autumn Bentgrass	4%

Seed shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. Where possible, seed stock shall come from a local source. The seed shall be furnished and delivered, in the proportion specified, in new, clean, sealed, and properly labeled containers. All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed which has become wet, moldy or otherwise damaged shall not be acceptable. The Contractor shall take care to handle and store the wildflower seed according to grower's recommendations and shall not subject the seed to extremes of heat, cold or moist conditions.

Refer to the Drawings for limits and types of seeding required and as directed by the Engineer.

Fertilizer Section M6.02.0 shall be supplemented by the following:

Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers which shall bear the manufacturer's certificate of compliance covering analysis. At least 50% by weight of the nitrogen content shall be derived from organic materials. Fertilizer shall contain not less than the percentages of weight of ingredients as follows or as recommended by the soil analysis:

Nitrogen  
10%

Phosphorus  
6%

Potash  
4%

Limestone Section M6.01.0 shall be amended so that dolomitic limestone shall be the only acceptable form.

Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 18% available phosphoric acid.

Water, including hose and all other watering equipment required for the work, shall be furnished by the Contractor to the site at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plant life. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct.

Hydromulch to cover hydroseeded areas shall be fiber processed from whole wood chips manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper or cardboard.

Moisture content of hydromulch shall not exceed 10%, plus or minus 3% as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than 2 pounds water per ¼ pound fiber.

The hydromulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.

The hydromulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be noninjurious to plant growth.

## CONSTRUCTION

### Inspections

Soil amendments, such as fertilizer, lime, and organic material, shall be based on tests of representative samples of compost topsoil to be used on the slopes. Contractor shall be responsible for ensuring timely testing and recommendations. Soil tests shall be by a laboratory acceptable to the Engineer. Soil test results and recommendations shall be delivered to the Engineer.

Notify the Engineer and arrange for inspections of areas to be seeded when:

- A. When planting soil (compost topsoil) has been spread and fine graded, amendments incorporated and before seeding.
- B. When seeding operations are beginning.
- C. When seeding operations are complete to establish a date when maintenance shall commence. When maintenance period is complete for Acceptance.

Notify the Engineer and arrange for inspections of areas to be top dressed and overseeded when:

- A. Existing grass areas have been mown to the required heights.
- B. When top dressing compost topsoil has been spread prior to seeding.
- C. When overseeding is complete to establish a date when Maintenance shall commence.
- D. When maintenance period is complete for Acceptance.

#### General Construction Methods

Placement of Compost Topsoil shall be installed and paid for under Item 751.7.

The season for seeding work shall typically be from April 1 to June 1 and from August 15 to October 15 with the following qualifications. The actual turf construction work shall be done only during periods within the season which are normal for such work as determined by weather conditions and by accepted practice in this locality and as accepted by the Engineer.

Seed only when the bed is in a friable condition, not muddy or hard. Areas where the soil condition is unacceptable may be required to be replaced and/or reworked and amended until acceptable to the Engineer at no additional cost to the Department.

Install erosion control matting in all drainage swales and on all slopes steeper than one vertical foot to three feet horizontal, per Item 767.9, MATTING FOR EROSION CONTROL.

#### Incorporation of Additives

Soil additives shall be spread and thoroughly incorporated into the top four (4) inches of the compost topsoil layer by harrowing or other methods approved by the Engineer.

#### Fine Grading of Seeded Areas and Preparation of the Seed Bed

The whole surface shall then be fine graded by hand raking. Remove large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Remove all stones over one (1) inch in diameter from the top three (3) inches of the compost topsoil. Compost topsoil shall also be free of smaller stones in excessive quantities as determined by the Engineer.

If seed bed is proposed to be seeded by hand broadcasting, smooth surface to meet finished grades with raking and broadcast seed according to requirements specified. Compact with rolling after seeding. If bed is proposed to be hydroseeded, roll and compact bed before seeding. The surface shall then be compacted with a roller or other suitable means to remove air pockets and achieve an even stable surface that is sufficiently porous to absorb water and allow root growth. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional borrow and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

### Turf Construction

Contractor shall obtain Engineer's written approval of fine grading and bed preparation before doing any seeding or hydroseeding.

### Seeding

Seeding shall be scheduled when rain is not expected for 48 hours and within seasonal dates specified. No seeding shall be done in windy or wet weather. Prepared compost topsoil bed shall be reviewed by the Engineer before seeding commences.

### Hand Seeding

For hand seeding rake soil lightly and roll to ensure seed is in firm contact with soil. Following rolling, water the seeded area thoroughly and evenly with a fine spray to penetrate the soil to a depth of at least two (2) inches.

Seeding shall be done in two directions at right angles to each other. Sow the seed with seeding device at the specified seeding rate as accepted by the Engineer.

### Hydroseeding

For hydroseeding, a mobile tank with a capacity of at least 500 gallons shall be filled with water and seed in quantities so they may be sprayed in the specified proportions per unit of area to be hydroseeded.

The slurry shall be thoroughly mixed by means of positive agitation in the tank. The slurry shall be applied by means of a centrifugal pump using the turret or hose application technique from the mobile tank. The hose or turret shall be equipped with a nozzle of a proper design to insure even distribution of the hydroseeding slurry over the area to be hydroseeded. The hose or turret shall be operated by a person thoroughly familiar with this type of seeding operation.

### Seeding

Differing quantities of hydromulch, fertilizer, superphosphate, and limestone shall be included in slurry mix depending on seed type, application requirements, and recommendations for amendments based on results of compost topsoil analysis.

### Preparing and Top Dressing of Areas to be Overseeded

All areas of existing or damaged grass areas shall be top dressed and overseeded as directed by the Engineer. Mow existing grass to a height of four (4) inches before topdressing and overseeding. Remove and discard all grass clippings and debris from the site.

Contractor shall spread approved, mechanically screened compost topsoil in areas of top dressing in accordance with Item 751.7, Compost Topsoil.

### Overseeding

Contractor shall obtain Engineer's written approval of top dressing of screened compost topsoil before doing any seeding.

Seed only when the top-dressed bed is in a friable condition, not muddy or hard.

Seed type and application rates for overseeding shall be the same as those listed in application rates for the particular seed mix specified for that area in locations as shown on the Drawings.

To maximize seed to soil contact, slice seeding is recommended for all areas to be overseeded. Mechanical seeding shall be undertaken in two separate passes at ninety degrees to each other. Rake soil lightly and roll to ensure seed is in firm contact with soil.

Following rolling, thoroughly and evenly water seeded areas with a fine spray to penetrate the top-dressed screened compost topsoil to a depth of at least four (4) inches.

#### Turf Maintenance

Maintenance shall begin immediately after any area is seeded and shall continue for a minimum 60-day active growing period following the completion of all turf construction work, and until final acceptance of the project. In the event that seeding operations are completed too late in the fall for adequate germination and growth of grass, then maintenance shall continue into the following spring and reseedling shall take place as necessary at that time. Adequate growth shall be as determined by the Engineer.

Maintenance shall include reseeding, erosion control, watering, weeding, fertilizing, and resetting and straightening of protective barriers. Herbaceous and woody weeds shall be removed from seeded areas.

Watering shall be provided as follows:

- A. The Contractor shall provide all labor and water required to establish all seed mixes, turf and wildflowers. Contractor shall water as required, during maintenance period to insure that one (1) inch of water is applied in the soil to the seeded areas and that water is maintained to a depth of two (2) inches or greater.
- B. Watering shall be done in a manner which will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply one complete coverage to the grass areas in an 8 hour period.

After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Engineer, fail to show a uniform stand of turf, for any reason whatsoever, shall be repaired, regarded as necessary until all areas are stable and covered with a satisfactory growth of turf. Repair and reseeding shall occur within specified seeding dates, and may require repeated applications of seed and fertilizer. All such repairs and reseeding shall be done by a method approved by the Engineer and shall be incidental to this item.

During the maintenance period, any decline in the condition of seeded areas shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall, at his own expense, engage professional horticulturists to inspect turf and to identify problems and recommend corrective procedures.

A satisfactory stand of turf, as determined by the Engineer, shall be required to be acceptable. Seeded areas shall have a close stand of grass with no weeds present and no bare spots greater than three (3) inches in diameter. All surfaces of the soil shall be stable and at least 90 percent of the grass established shall be permanent grass species. At the time of acceptance, the Contractor shall remove temporary barriers used to protect turf areas. Absolutely no debris may be left on the site.

### COMPENSATION

NHESP Restoration Area Seed Mix will be measured per for payment by the square yard, complete in place.

NHESP Restoration Area Seed Mix will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for all fine grading, amendments, seeding, maintenance, mowing and watering, but all costs in connection therewith shall be included in the Contract unit price bid.

Placement and grading of compost topsoil will be paid for separately under Compost Topsoil, Item 751.7. Matting for erosion control will be paid for separately under Matting for Erosion Control, Item 767.9.

### ITEM 765.4

### BIOSWALE SEED MIX

### SQUARE YARD

The work under this item shall conform to the applicable requirements of Section 765 of the Standard Specifications, except as amended and supplemented as indicated on the drawings and as specified below.

### DESCRIPTION

The work of this Section consists of all seeding work and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

- A. Incorporation of Additives for Seeding
- B. Fine Grading
- C. Mechanical Seeding
- D. Hydroseeding
- E. Hydromulching
- F. Maintenance and protection

All seeding work shall be done by a firm experienced in seeding work having a minimum of five years experience with seeding installation. Prior to beginning work, the Contractor shall furnish proof of qualifications to the Engineer for approval.

Hydromulch installation work shall include the installation of wood fiber mulch, as shown on the Drawings or as indicated in the specifications, herein. Hydromulch shall be installed on areas within the project limits. Matting for Erosion Control shall be used on all areas seeded with the same mixes on all slopes that are steeper than one vertical foot to three horizontal feet within the project limit as specified under Item 767.9, MATTING FOR EROSION CONTROL.

The work of this Section includes topdressing and overseeding the existing or grass cover or repairing grass damaged by construction and as shown in the Drawings and as directed. Bioswale Mix is for use in three of the landscaped areas as shown on the plans between Stations 114+00 and 115+00 and 187+00 and 188+00. Application of this mix shall be as shown on the Drawings and as directed.

#### Samples and Submittals

At least 60 days prior to ordering, the Contractor shall submit to the Engineer material specifications and (where applicable) installation instructions attesting that the following materials meet the requirements specified. No material shall be ordered until submittals have been approved by the Engineer. Delivered materials shall match approved materials.

- A. Seed
- B. Fertilizer
- C. Ground limestone
- D. Superphosphate
- E. Hydromulch

Seed: A manufacturer's Certificate of Compliance shall be submitted with each shipment of seed. These Certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. Only current year's crop seed shall be permitted. No seed may be sown until the Contractor has submitted the Certificates of Compliance.

Hydroseed and Hydromulch: Prior to the start of work, the Engineer shall be furnished with a certified statement for approval as to the number of pounds of seed, mulch and tackifier to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding or hydromulching that can be covered with the quantity of solution in the hydroseeder.

#### MATERIALS

Seed Section M6.03.0 shall be amended as follows.

The following seed mix, conforming in plant species to the percentages specified, shall be used in areas as indicted on the drawings.

Supply 31 Lbs/1750 SF of the following Seed for ITEM 765.4, Bioswale Seed Mix

Seed Mixture:**Name**

Virginia Wild Rye, (*Elymus virginicus*)  
Little Bluestem, (*Schizachyrium scoparium*)  
Big Bluestem, (*Andropogon gerardii*)  
Creeping Red Fescue, (*Festuca rubra*)  
Switch Grass, (*Panicum virgatum*)  
Partridge Pea, (*Chamaecrista fasciculata*)  
Deer Tongue, (*Panicum clandestinum*)  
Indian Grass, (*Sorghastrum nutans*)  
Ox Eye Sunflower, (*Heliopsis helianthoides*)  
Common Milkweed, (*Asclepias syriaca*)  
Spotted Joe Pye Weed, (*Eupatorium maculatum*)  
Grass Leaved Goldenrod, (*Euthamia graminifolia*)  
Blue Vervain, (*Verbena hastata*)  
New England Aster, (*Aster novae-angliae*)  
Early Goldenrod, (*Solidago juncea*)

Seed shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. Where possible, seed stock shall come from a local source. The seed shall be furnished and delivered, in the proportion specified, in new, clean, sealed, and properly labeled containers. All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed which has become wet, moldy or otherwise damaged shall not be acceptable. The Contractor shall take care to handle and store the wildflower seed according to grower's recommendations and shall not subject the seed to extremes of heat, cold or moist conditions.

Refer to the Drawings for limits and types of seeding required and as directed by the Engineer.

Fertilizer Section M6.02.0 shall be supplemented by the following:

Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers which shall bear the manufacturer's certificate of compliance covering analysis. At least 50% by weight of the nitrogen content shall be derived from organic materials. Fertilizer shall contain not less than the percentages of weight of ingredients as follows or as recommended by the soil analysis:

Nitrogen	Phosphorus	Potash
10%	6%	4%

Limestone Section M6.01.0 shall be amended so that dolomitic limestone shall be the only acceptable form.

Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 18% available phosphoric acid.



Water, including hose and all other watering equipment required for the work, shall be furnished by the Contractor to the site at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plant life. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct.

Hydromulch to cover hydroseeded areas shall be fiber processed from whole wood chips manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper or cardboard.

Moisture content of hydromulch shall not exceed 10%, plus or minus 3% as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than 2 pounds water per ¼ pound fiber.

The hydromulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.

The hydromulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be noninjurious to plant growth.

## CONSTRUCTION

### Inspections

Soil amendments, such as fertilizer, lime, and organic material, shall be based on tests of representative samples of compost topsoil to be used on the slopes. Contractor shall be responsible for ensuring timely testing and recommendations. Soil tests shall be by a laboratory acceptable to the Engineer. Soil test results and recommendations shall be delivered to the Engineer.

Notify the Engineer and arrange for inspections of areas to be seeded when:

- A. When planting soil (compost topsoil borrow) has been spread and fine graded, amendments incorporated and before seeding.
- B. When seeding operations are beginning.
- C. When seeding operations are complete to establish a date when maintenance shall commence. When maintenance period is complete for Acceptance.

Notify the Engineer and arrange for inspections of areas to be top dressed and overseeded when:

- A. Existing grass areas have been mown to the required heights.
- B. When top dressing compost topsoil borrow has been spread prior to seeding.
- C. When overseeding is complete to establish a date when Maintenance shall commence.
- D. When maintenance period is complete for Acceptance.

### General Construction Methods

Placement of Compost Topsoil shall be installed and paid for under Item 751.7.

The season for seeding work shall typically be from April 1 to June 1 and from August 15 to October 15 with the following qualifications. The actual turf construction work shall be done only during periods within the season which are normal for such work as determined by weather conditions and by accepted practice in this locality and as accepted by the Engineer.

Seed only when the bed is in a friable condition, not muddy or hard. Areas where the soil condition is unacceptable may be required to be replaced and/or reworked and amended until acceptable to the Engineer at no additional cost to the Department.

Install erosion control matting in all drainage swales and on all slopes steeper than one vertical foot to three feet horizontal, per Item 767.9, MATTING FOR EROSION CONTROL.

### Incorporation of Additives

Soil additives shall be spread and thoroughly incorporated into the top four (4) inches of the compost topsoil layer by harrowing or other methods approved by the Engineer.

### Fine Grading of Seeded Areas and Preparation of the Seed Bed

The whole surface shall then be fine graded by hand raking. Remove large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Remove all stones over one (1) inch in diameter from the top three (3) inches of the compost topsoil. Compost topsoil shall also be free of smaller stones in excessive quantities as determined by the Engineer.

If seed bed is proposed to be seeded by hand broadcasting, smooth surface to meet finished grades with raking and broadcast seed according to requirements specified. Compact with rolling after seeding. If bed is proposed to be hydroseeded, roll and compact bed before seeding. The surface shall then be compacted with a roller or other suitable means to remove air pockets and achieve an even stable surface that is sufficiently porous to absorb water and allow root growth. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional borrow and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

### Turf Construction

Contractor shall obtain Engineer's written approval of fine grading and bed preparation before doing any seeding or hydroseeding.

### Seeding

Seeding shall be scheduled when rain is not expected for 48 hours and within seasonal dates specified. No seeding shall be done in windy or wet weather. Prepared compost topsoil bed shall be reviewed by the Engineer before seeding commences.

### Hand Seeding

For hand seeding rake soil lightly and roll to ensure seed is in firm contact with soil. Following rolling, water the seeded area thoroughly and evenly with a fine spray to penetrate the soil to a depth of at least two (2) inches.

Seeding shall be done in two directions at right angles to each other. Sow the seed with seeding device at the specified seeding rate as accepted by the Engineer.

#### Hydroseeding

For hydroseeding, a mobile tank with a capacity of at least 500 gallons shall be filled with water and seed in quantities so they may be sprayed in the specified proportions per unit of area to be hydroseeded.

The slurry shall be thoroughly mixed by means of positive agitation in the tank. The slurry shall be applied by means of a centrifugal pump using the turret or hose application technique from the mobile tank. The hose or turret shall be equipped with a nozzle of a proper design to insure even distribution of the hydroseeding slurry over the area to be hydroseeded. The hose or turret shall be operated by a person thoroughly familiar with this type of seeding operation.

#### Seeding

Differing quantities of hydromulch, fertilizer, superphosphate, and limestone shall be included in slurry mix depending on seed type, application requirements, and recommendations for amendments based on results of compost topsoil soil analysis.

#### Preparing and Top Dressing of Areas to be Overseeded

All areas of existing or damaged grass areas shall be top dressed and overseeded as directed by the Engineer. Mow existing grass to a height of four (4) inches before topdressing and overseeding. Remove and discard all grass clippings and debris from the site.

Contractor shall spread approved, mechanically screened compost topsoil in areas of top dressing in accordance with Item 751.7, Compost Topsoil.

#### Overseeding

Contractor shall obtain Engineer's written approval of top dressing of compost topsoil before doing any seeding.

Seed only when the top-dressed bed is in a friable condition, not muddy or hard.

Seed type and application rates for overseeding shall be the same as those listed in application rates for the particular seed mix specified for that area in locations as shown on the Drawings.

To maximize seed to soil contact, slice seeding is recommended for all areas to be overseeded. Mechanical seeding shall be undertaken in two separate passes at ninety degrees to each other. Rake soil lightly and roll to ensure seed is in firm contact with soil.

Following rolling, thoroughly and evenly water seeded areas with a fine spray to penetrate the top-dressed compost topsoil to a depth of at least four (4) inches.

### Turf Maintenance

Maintenance shall begin immediately after any area is seeded and shall continue for a minimum 60-day active growing period following the completion of all turf construction work, and until final acceptance of the project. In the event that seeding operations are completed too late in the fall for adequate germination and growth of grass, then maintenance shall continue into the following spring and reseeded shall take place as necessary at that time. Adequate growth shall be as determined by the Engineer.

Maintenance shall include reseeding, erosion control, watering, weeding, fertilizing, and resetting and straightening of protective barriers. Herbaceous and woody weeds shall be removed from seeded areas.

Watering shall be provided as follows:

- A. The Contractor shall provide all labor and water required to establish all seed mixes, turf and wildflowers. Contractor shall water as required, during maintenance period to insure that one (1) inch of water is applied in the soil to the seeded areas and that water is maintained to a depth of two (2) inches or greater.
- B. Watering shall be done in a manner which will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply one complete coverage to the grass areas in an 8 hour period.

After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Engineer, fail to show a uniform stand of turf, for any reason whatsoever, shall be repaired, regarded as necessary until all areas are stable and covered with a satisfactory growth of turf. Repair and reseeding shall occur within specified seeding dates, and may require repeated applications of seed and fertilizer. All such repairs and reseeding shall be done by a method approved by the Engineer and shall be incidental to this item.

During the maintenance period, any decline in the condition of seeded areas shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall, at his own expense, engage professional horticulturists to inspect turf and to identify problems and recommend corrective procedures.

A satisfactory stand of turf, as determined by the Engineer, shall be required to be acceptable. Seeded areas shall have a close stand of grass with no weeds present and no bare spots greater than three (3) inches in diameter. All surfaces of the soil shall be stable and at least 90 percent of the grass established shall be permanent grass species. At the time of acceptance, the Contractor shall remove temporary barriers used to protect turf areas. Absolutely no debris may be left on the site.

## COMPENSATION

Bioswale seed mix will be measured per for payment by the square yard, complete in place.

Bioswale seed mix will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for all fine grading, amendments, seeding, maintenance, mowing and watering, but all costs in connection therewith shall be included in the Contract unit price bid.

Placement and grading of compost top soil will be paid for separately under Compost Top Soil, Item 751.7. Matting for erosion control will be paid for separately under Matting for Erosion Control, Item 767.9.

### ITEM 767.12

### COMPOST FILTER TUBES

### FOOT

The purpose of this item is to provide a linear, compost-filled tube for filtering suspended sediments from storm water flow. This item shall conform to the requirements of Section 751 and 767 of the Standard Specifications and the following:

Material for the filter tubes shall be compost meeting M1.06.0, except that no manure or bio-solids shall be used. In addition, no kiln-dried wood or construction debris shall be allowed. Compost shall pass through a 3 inch sieve.

Tubes for compost filters shall be a 12 to 18 inches in diameter, and shall be jute mesh or approved biodegradable material. Additional tubes shall be used at the direction of the Engineer.

A 1 foot wide by 2 inch deep wedge of compost spread along the top of the filter tube shall be incidental to this item.

Stakes for anchors, if required, shall be nominal 2x2 stakes.

Tubes of compost may be filled on site or shipped. Tubes shall be placed, filled and staked in place as required to ensure stability against water flows. All tubes shall be tamped to ensure good contact with soil.

The Contractor shall ensure that the filter tubes function as intended at all times. Tubes shall be inspected after each rainfall and at least daily during prolonged rainfall. The Contractor shall immediately correct all deficiencies, including, but not limited, to washout, overtopping, clogging due to sediment and erosion, and review location of tubes in areas where construction activity causes drainage runoff to ensure that the tubes are properly located for effectiveness. Where deficiencies exist, such as overtopping or wash-out, additional staking or compost material shall be installed as directed by the Engineer. Sediment deposits shall be removed as necessary to maintain the filters in working condition.

Filter tube fabric and stakes shall be removed when site conditions are sufficiently stable to prevent surface erosion, and after receiving permission to do so from the Engineer. All tube fabric shall be cut and removed and disposed of off-site by the Contractor. At the direction of the Engineer, the Contractor may rake out and seed compost so that it is no greater than 2 inches (50 mm) in depth on soil substrate.

### COMPENSATION

Measurement for this item shall be by the foot of compost installed, approved, and maintained in place.

Payment shall be per foot and shall be compensation for all labor equipment and materials necessary to complete the work specified above, including, but not limited to, stakes and tube fabric, compost mulch wedge along top of tubes, removal and disposal of fabric and stakes, raking and seeding of compost.

### ITEM 767.9

### MATTING FOR EROSION CONTROL

### SQUARE YARD

Work under this item shall conform to the plans and the relevant provisions of Section 767 and the following:

### DESCRIPTION

The work shall include the furnishing and placement of permanent erosion control matting for ditch and slope protection and stabilization as shown on the plans and as directed by the Engineer, after the placement of compost topsoil and seed. Matting shall be placed on all slopes steeper than 1 vertical foot to 3 horizontal feet and all drainage swales.

### MATERIALS

Furnish material that is clean, sound and free of rips or tears.

Stables shall be U-shaped with eight (8) inch legs and one (1) inch crowns from 6 gauge or larger wire.

Erosion control mats shall be undyed, untreated, biodegradable, jute, coconut coir, or other approved yarn woven into a plain weave mesh with approximately 0.65 to one (1) inch square openings.

Jute mesh shall be a uniform open plain weave fabricated from jute yarn that does not vary in thickness by more than ½ from its normal diameter. The mesh shall not exceed one (1) by one (1) inch in size and with an average weight of 0.5 kg/cm +/- 5% when tested in a standard atmospheric condition according to ASTM D 1776.

### CONSTRUCTION METHODS

Install according to the manufacture's recommendations. Install mats to soil surfaces that are at final grade, stable, firm, and free of rocks or other obstructions.

Spread mats evenly and smoothly, without stretching, to ensure direct contact with the soil at all points. Unroll fabric parallel to the drainage flow direction. Drive all staples flush with soil surface.

Repair damage areas immediately. Restore the soil in damaged areas to finished grade, re-fertilize, and re-seed.

Place upslope mat end in a vertical, six (6) inch deep slot. Staple the mat end along the bottom of the slot at twelve (12) inch intervals. Backfill the slot and compact. Staple the outer edges at six (6) foot intervals. Overlap the abutting edges by four (4) inches. Staple the overlap at three (3) foot intervals.

Overlap the roll ends by eighteen (18) inches with the upslope end on top. Staple the overlap at twelve (12) inch intervals.

Turn the downslope mat end under six (6) inches of mat and staple along the fold at twelve (12) inch intervals. Staple throughout the mat at staggered two (2) foot intervals.

For swale installations, construct check slots every twenty-five (25) feet. Dig a six (6) inch slot perpendicular to the flow direction. Tuck 3 folds of mat into the slot. Staple the mat securely along the bottom of the slot and continue unrolling the fabric in the desired direction.

### COMPENSATION

Matting for erosion control will be measured for payment by the square yard, complete in place. Overlapped matting will not be measured for payment.

Matting for erosion control will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

<u>ITEM 772.366</u>	<u>FIR – CANAAN 8-10 FEET</u>	<u>EACH</u>
<u>ITEM 773.438</u>	<u>PINE – WHITE 8-10 FEET</u>	<u>EACH</u>
<u>ITEM 776.551</u>	<u>MAPLE – RED – ‘OCTOBER GLORY’ 3-3.5 INCH CALIPER</u>	<u>EACH</u>
<u>ITEM 782.538</u>	<u>REDBUD – EASTERN 8-10 FEET</u>	<u>EACH</u>
<u>ITEM 783.05</u>	<u>ROBIN HILL SERVICEBERRY 3-3.5 INCH CALIPER</u>	<u>EACH</u>
<u>ITEM 783.541</u>	<u>YELLOWWOOD 3-3.5 INCH CLAIPER</u>	<u>EACH</u>
<u>ITEM 785.183</u>	<u>BOXWOOD – COMMON 3-4 FEET</u>	<u>EACH</u>
<u>ITEM 785.733</u>	<u>INKBERRY – COMPACT 24-30 INCH</u>	<u>EACH</u>
<u>ITEM 786.671</u>	<u>MOUNTAIN LAUREL 24-30 INCH</u>	<u>EACH</u>
<u>ITEM 789.8</u>	<u>CHOKEBERRY – RED 18-24 INCH</u>	<u>EACH</u>
<u>ITEM 790.133</u>	<u>CORALBERRY SHRUB – CHENAULT 2-3 FEET</u>	<u>EACH</u>
<u>ITEM 791.313</u>	<u>FOTHERGILLA – DWARF 18-24 INCH SPREAD</u>	<u>EACH</u>
<u>ITEM 794.322</u>	<u>SUMAC SHRUB – FRAGRANT 18-24 INCH</u>	<u>EACH</u>
<u>ITEM 794.731</u>	<u>SUMMERSWEET SHRUB 2-3 FEET</u>	<u>EACH</u>
<u>ITEM 795.053</u>	<u>VIBURNUM – Highbush CRANBERRY 3-4 FEET</u>	<u>EACH</u>
<u>ITEM 795.153</u>	<u>WINTERBERRY – MALE 24-30 INCH</u>	<u>EACH</u>
<u>ITEM 795.157</u>	<u>WINTERBERRY – FEMALE 24-30 INCH</u>	<u>EACH</u>

The work under these items shall conform to the applicable requirements of Section 771, PLANTING TREES, SHRUBS AND GROUND COVER, of the Standard Special Provisions.

### **ITEM 816.01 TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 1 LUMP SUM**

**LOC. 1: Carlisle Road (Route 225) at Main Street (Route 27)**

#### **SCOPE OF TRAFFIC SIGNAL WORK**

The work to be done under this item consists of furnishing and the installation of a new traffic control signal system at the above intersection, complete with loop detection, signal posts, controllers, cabinets, foundations, wire and cable, emergency vehicle preemption system, and all other equipment, materials and incidental costs necessary to furnish, install and program a complete and functioning traffic control system as specified and as shown in the contract documents.

All work under these items shall conform to the relevant provisions of Section 800 of the Standard Specification, the 2009 Manual on Uniform Traffic Control Devices (MUTCD), and the following technical provisions:

#### **GENERAL REQUIREMENTS**

A list of the major traffic signal items required is included on the Plans. Each component supplied must be on the most recent MassDOT's Approved Equipment List, unless authorization from MassDOT is provided for use of equipment on a "test" or "pilot" basis.

Within 30 days following execution of the Contract, the Contractor shall 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 shall be commenced by the Contractor until approval of the shop drawings and the manufacturer's data has been received in writing from the Engineer. Approval of these drawings shall be general in character and shall not relieve the Contractor from the responsibility of, or the necessity of, furnishing materials and workmanship conforming to the plans and specifications.

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

Any Electrical Contractor performing work must be on the MassDOT Approved Contractor List and also have International Municipal Signal Association (IMSA) Certification as a Traffic Signal Electrician Level II.

#### SERVICE CONNECTIONS

The Contractor shall coordinate with the servicing utility company for installation of a new service meter to each new controller cabinet.

Service connections shown on the plans are approximate only. The Contractor shall determine exact locations from the servicing utility, arrange to complete the service connections, and be responsible for all charges incidental thereto.

A 100-ampere meter socket approved by the servicing utility company shall be furnished and installed on the side of the control cabinet by the serving utility company.

A 3" PVC Conduit shall be installed from the controller cabinet to the utility pole and/or electric manhole, which will supply electrical service to the controller cabinet. This conduit shall be encased in concrete where crossing roadways and/or driveways.

#### FLASHING OPERATION

Changes from automatic flashing to stop-and-go operation and from stop-and-go to automatic flashing operation shall occur as set forth in Section 4 of the 2009 MUTCD.

#### TRAFFIC SIGNAL EQUIPMENT

The traffic signal controller unit (CU), malfunction management unit (MMU) and all other ancillary traffic signal control components included in the traffic control cabinet shall comply with the National Electrical Manufacturers Association (NEMA) Standard No. TS 2-1998, Traffic Controller Assemblies with National Transportation Communications for ITS Protocol (NTCIP) Requirements.

#### TRAFFIC SIGNAL CONTROLLER

The controller unit shall be a keyboard-entry menu-driven unit conforming to the Standard Specifications, with internal time base coordination, emergency preemption, and programmatic capability.

Controllers shall conform to Section 3, Controller Units of NEMA No. TS 2, Traffic Controller Assemblies. The controller unit shall meet all applicable requirements of the NEMA Standard Publication No. TS 2 Type 1 and the Department's 1995 Standard Specifications. Controllers shall utilize an input/output interface conforming to Section 3.3.1 of the NEMA TS 2 Standard for all input/output functions with the back panel terminals and facilities, the malfunction management unit, detector rack assemblies and auxiliary devices.

The controller shall be complete with a module, including modem card and physical connector to support closed loop communication.

#### BUS INTERFACE UNITS

The Bus Interface Unit (BIU) shall comply with Section 8 of the NEMA TS 2 Standard. The BIU shall be fully interchangeable with any other manufacturer's unit and interchangeable in a NEMA TS 2 Type 1 cabinet assembly.

The BIU shall perform the interface function between Port 1 at the controller unit, the malfunction management unit, loop detector rack assembly, and the back panel terminal and facilities.

As a minimum, two (2) LED indicators shall be provided on the BIU front panel. One indicator shall serve a dual use; as a power on indication and as a diagnostic indicator for proper operation of the device. The second indicator shall serve as a transmit indicator illuminating each time data is transmitted.

#### MALFUNCTION MANAGEMENT UNITS

The malfunction management units (MMU) shall comply with Section 4 of the NEMA TS 2 standard. The MMU shall be capable of operating as either a Type 16 with 16 channels (8 vehicle, 4 pedestrian, 4 overlap) or a Type 12 with 12 channels (8 vehicle, 4 overlap). The MMU's supplied shall be configured to operate as Type 16 units.

The MMU's in either the Type 16 or Type 12 configuration shall be capable of operating in a NEMA TS 2 Type 2 cabinet, a NEMA TS 2 Type 1 cabinet, or a NEMA TS 1 cabinet without loss of functionality. The MMU shall be connected directly to the controller unit to support enhanced MMU monitoring of controller operations.

#### LOAD SWITCHES

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

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

***Note: The controller cabinet assembly shall be initially supplied with a full compliment of load switches to accommodate each available position of the back panel.***

#### FLASHER

Flashers shall 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 shall comply with Subsection 6.4 of the NEMA TS 2 Standard.

The field electrical loading for flash operation shall 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.

***Note: The controller cabinet assembly shall be initially supplied with a full compliment of flash transfer relays to accommodate each available position of the back panel.***

#### EMERGENCY VEHICLE PREEMPTION

The emergency vehicle preemption system shall be installed in the same cabinet as the controller.

The emergency vehicle preemption control system shall consist of a data-encoded phase selector to be installed within the traffic control cabinet. 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 shall generate a preempt call to the controller initiating a preemption operation as shown on the plans.

The optical detectors shall be single input, single output units used to control one approach. All traffic signal installations shall be supplied with a minimum of two optical detectors unless otherwise noted in the major item list.

The phase selector shall be a rack-mounted plug-in two or four channel, dual priority device. The phase selector shall plug into a shelf-mounted single card slot chassis. Programming the phase selector shall be via a PC-based computer utilizing unit specific software. One copy of software, on 3.5" floppy disk shall be supplied and licensed to the Department. A hard copy of final programming data shall be left in the control cabinet. The CONTRACTOR shall supply a complete set of interface cables for phase selector to laptop connection.

The CONTRACTOR shall install confirmation strobe at the traffic signal location as shown on the plans. The confirmation strobe shall 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 shall have a clear/white lens.

The CONTRACTOR shall be responsible for the proper programming of the phase selector, orientation of the optical detectors, and all other work necessary to provide a complete and operating emergency vehicle preemption system.

The CONTRACTOR may be required to field adjust the location of the optical detectors for optimum line of sight detection in the presence of the Engineer to properly detect preemption calls from approaching vehicles.

#### VEHICLE DETECTOR AMPLIFIERS

The loop detector amplifiers shall be supplied as two-channel rack mounted units with programmable delay and extension timing, however, all delay and extension programming shall be completed internally in the controller unit.

A chart shall be permanently affixed to the controller cabinet door, which labels each amplifier channel. The chart shall indicate the detector number, street name, approach direction, lane assignment, corresponding phase and terminal number for each amplifier channel.

The detector lead-in cables shall also be similarly labeled, both in the controller cabinet and in the pull box containing the detector lead-in splice. This labeling and attachment shall be of durable materials such as brass or plastic, attached by wire or plastic ties. Adhesive attachment of the label shall not be acceptable.

#### VEHICLE LOOP DETECTORS

Wire loop detectors shall be installed in the roadway for vehicle detection. In advance of the loop detector installation, the Contractor shall mark, on site, the loop detectors with any changes required by field conditions such as manholes. The loop detector layout shall be inspected and approved by the Engineer before the loop detectors are installed.

Loop wire shall be encased in a protected plastic tubing of PVC or polyethylene plastic, IMSA 51-5, 0.25 inch outside diameter, and the wire may have cross-linked polyethylene insulation or it may have THHN/THWN insulation.

Splicing insulator shall be an approved re-enterable rigid body splices kit with a non-hardening sealing compound compatible with the wire insulation.

**Splice and Connection:** Splicing and connection shall be made in the pull box nearest the roadway loop sensor but not exceeding four loops per pull box. All loops included in a detector group as shown on the plans shall be spliced in a single pull box. Each lead and lead-in connector shall be stripped back and spliced using a pressure type wire connector applied with a crimping tool. Multiple loop sensors shall be identified as detailed on the plans.

Lead-in splicing shall be staggered to prevent contact with each other. Each crimped splice shall be soldered and insulated. The insulation material shall be heat-shrunked polyolefin. The shielded lead-in cable outer jacket and shield shall be stripped back sufficiently to ensure that the shield cannot come into contact with the spliced conductors. Follow the instructions of the kit manufacturer for this procedure when installing the re-enterable splice kit.

***NOTE WELL: The above splice shall be done on the day of the loop wire installation to prevent the entrance of any moisture into the plastic tubing.***

The lead-in conductors shall be connected to the appropriate terminals in the controller cabinet, by using crimped or soldered terminal ends. The heat source for soldering shall be electrical not exceeding 30W capacity.

**Testing of Loops:** The following test procedure shall be performed in the presence of the Engineer before and after the loop sensor is sealed in the pavement as detailed below. The cost of equipment, labor, and materials to perform such testing and similar re-testing following repairs, replacement, or adjustment of any detector within the project area shall be included in the contract unit price for this Item.

After installation of wire loop sensors in the roadway and installation of shielded lead-in connecting the loop sensors to the controller cabinet, each loop sensor and lead-in combination shall be tested (at the controller cabinet) for proper installation. The resistance from lead to lead of the same loop shall not exceed three (3) ohms per one thousand (1000) feet as measured by a high quality meter suitable for measurements of low resistance in the range of 1 to 6 ohms.

A megohm meter test at 500 volts DC shall be made between the two leads of a loop/lead-in combination temporarily spliced together, but otherwise disconnected from all terminals, and the shield drain wire and the earth ground connection. These resistances shall be at least one hundred (100) megohms.

A megohm meter test at 500 volts DC shall be made between lead-in shield and the earth ground rod. This resistance shall be at least one hundred (100) megohms.

The meter used for these tests shall be checked for calibration each day of use by using a resistor block of 5% resistors simulating loads of 1 megohm, 20 megohm and 100 megohms. The observed meter reading shall be 10% of the nominal resistor load.

If any loop sensor and lead-in combination fails to pass any one of the four (4) tests, it shall be repaired and then re-tested on two occasions at least two (2) weeks apart and then shall pass on each re-test occasion. If the loop sensor lead-in combination does not pass all these re-tests, a new loop sensor and/or lead-in shall be installed, and shall pass these tests, at no additional cost.

After the above tests have been satisfactorily completed, all loop sensor/shielded lead-in inductance shall be measured and a written report of the results shall be filed with the Engineer and a copy stored with the “box prints” at the intersection.

#### TRAFFIC CONTROLLER CABINET

The controller cabinets shall conform to the NEMA TS 2 Type 1 Standards, Section 7. Cabinet size shall be as shown below. It should be noted that approximate cabinet dimensions are in inches. The Cabinet shall be a ground-mounted type as shown on the plan.

Item Number	NEMA TS 2 Cabinet Type	Cabinet Size (Nominal) (HxWxD*)	Back Panel	Mounting	Malfunction Management Unit
816.01	NEMA Size 6	56"x 44"x 28"	12-Position	Ground	16 Channel

\* Approximate cabinet dimensions are provided in inches.

The control cabinet shall be made of aluminum with an interior painted aluminum and an exterior painted black.

***Note: The control cabinet shall be initially wired with a “D” harness. All wires for this harness shall be properly terminated on the backpanel.***

The cabinet shall also be wired with a normally closed switch connected to a user defined input to the controller for remote monitoring of the control cabinets’ door open status.

***Note: No Manual Police Button shall be provided.***

Controller cabinet foundations shall not obstruct a sidewalk or crosswalk so that passage by physically challenged persons is impaired.

The following requirements are applicable to each signalized location and are designed for effective use of a laptop computer in conjunction with traffic signal controllers. These requirements are also designed to permit all engineers, electricians and technicians (including those who are disabled but ambulatory) to work in the cabinet in a safe, effective and comfortable manner. To this extent, the following meets applicable ADA requirements.

1. Adjust the control cabinet height by use of a cabinet extender, adjust the placement of cabinet shelves, adjust the height of the cabinet foundation or provide any combination of these three items so that the top of the LCD or other visual display window of both the local controller and the master controller is no more than 48" above finished grade in front of the cabinet. The top of the cabinet door opening shall be at least 5'8" above finished grade. Any technical provision, plan detail, standard specification or standard drawing to the contrary shall not apply to the extent that it may conflict with this viewing height requirement.
2. Furnish and install one slide-out/slide-in shelf or swing-out/swing-in shelf appropriate for the size and load of a laptop computer. This moveable shelf shall support the bottom of the laptop computer at a height between 3'-4" and 3'-8" above finished grade in front of the cabinet.
3. Furnish and install a paved pad in front of the control cabinet. This pad may be of bituminous concrete or cement concrete, built in accordance with the sidewalk specification applicable to this project, approximately level, approximately 1" above the surrounding unpaved surface, or at even grade with the adjacent surface if paved. This pad shall abut the front of the cabinet; project at least 1' to each side of the cabinet and at least 3' in front. No pad is required if the front of the cabinet immediately abuts an existing or proposed paved sidewalk or other paved surface.
4. Both the firmware and software version in each timer unit shall be the same throughout the project, and shall be the latest version available on the market. In addition, the contractor shall promptly furnish to the owner and install all upgraded versions of both firmware and software through the last day of the inspection period, guarantee period or warranty period, whichever date is later.
5. The contractor shall furnish one cable with each new timer unit to connect a controller timing mechanism to a laptop computer. This cable shall have a termination at one end to match the controller. It shall have a termination on the other end to match the type of serial port found on laptop computers, usually DB9. This cable shall be wired to provide serial RS232C communication between the controller and the computer.
6. Payment for the work described above shall be deemed to be incidental to and included in the prices bid for various items of traffic signal work, and no additional payment shall be made for the work described above.

### **TESTING OF GROUNDING SYSTEM**

The Contractor shall perform testing of the equipment grounding system in the presence of the Engineer in accordance with the Standard Specifications.

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## **POSTS AND BASES**

Signal base foundations shall not obstruct a sidewalk so that passage by physically challenged persons is impaired

## **SIGNAL HEADS**

Signal heads shall be rigid mounted. All traffic signal lenses shall be 12" in diameter unless otherwise noted on the plans. All signal heads shall be equipped with light emitting diode (L.E.D.) 12" modules as noted on the plans.

Signal heads shall be made of aluminum. Signal heads shall be installed with cut tunnel visors unless otherwise noted on the major items list on the plans.

## **TRAFFIC SIGNAL LED MODULES**

The LED module shall be an approved item from MassDOT's Traffic Control Devices Approved Equipment List. See "Traffic Controls" under "Qualified Construction Materials" on the Department website:

[http://www.mhd.state.ma.us/downloads/trafficMaterials/trafficSignalControls\\_1209.pdf](http://www.mhd.state.ma.us/downloads/trafficMaterials/trafficSignalControls_1209.pdf)

To prevent the LED module warranty from being voided, the connecting leads on the module shall not be cut. The original LED module leads shall be connected to the signal head terminal block as continuous wire without splices.

The LED signal module will be replaced or repaired by the manufacturer if it exhibits one of the following:

1. A failure due to workmanship or material defects within the first 60 months of field operation
2. A greater than 40 percent light output degradation or a fall below minimum intensity levels (as defined by the latest ITE performance specifications) within the first 36 months of field operation.

## **PEDESTRIAN HEADS**

Pedestrian head indications shall be illuminated L.E.D. type displaying the graphical symbols of a walking person and/or upraised hand. All LED indications on the pedestrian signal shall have an automatic dimming circuit for night illumination to reduce long-term degradation to the LEDs. Pedestrian heads shall be made of aluminum.

Each visual pedestrian indication shall be complemented by a time display indication. Each time display indication shall be self-programming and microprocessor based, with red LEDs used in the display. The time display will countdown the amount of time remaining in each flashing don't walk time interval for viewing by the ambulatory public.

## **PEDESTRIAN PUSH BUTTONS**

Pedestrian push button controls shall be raised from or flush with their housings and shall be a minimum of 2" in the smallest dimension. The force required to activate the controls shall be no greater than 5lbs.

Each push button shall be complemented with an audible and vibro-tactile indication with LED confirmation light. The R10-3e sign shall be provided with each pedestrian push button. Each separately phased pedestrian movement shall have its own distinctive audible emanation in order for visually impaired pedestrians to discriminate which phase is appropriate given his or her destination and/or direction of travel.

The audible emanation shall be a percussion type sound. No buzzer or ringing type sounds will be acceptable. The output level of the audible pedestrian signal shall vary in intensity with significant fluctuations in ambient noise conditions. At a minimum, the output level shall vary in intensity from daytime to nighttime operations.

Pedestrian push buttons shall be located as close as practicable to the sidewalk curb ramp serving the controlled crossing and shall 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 push buttons and/or legends on the pedestrian push button signs should clearly indicate which crosswalk signal is actuated by each pedestrian push button.

***Note: The contractor is responsible for determining the correct arrow orientation of the R10-3e sign and or pedestrian push button.***

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

## PAINTING

All new traffic signal equipment shall be painted in accordance to the relevant provision of Section 815 of the Standard Specifications and the following:

Controller cabinet	(Exterior)	-	Aluminum
	(Interior)	-	Aluminum
Posts and Bases		-	Aluminum
Signal housings	(Back)	-	Yellow
	(Front)	-	Black
Signal housing supports		-	Yellow
Visors of signal housing	(Outside)	-	Yellow
	(Inside)	-	Black
Meter socket		-	Aluminum

## SOFTWARE

All local controller, malfunction management unit, loop detector amplifier and emergency vehicle preemption software shall be supplied with the latest available revision. Any software upgrades released by the manufacturer shall be supplied at no additional cost to the Town for a period of five years after acceptance of the traffic signal installation.

## DOCUMENTATION

Each programmable local hardware component (i.e. controller, malfunction management unit, loop detector amplifier, emergency vehicle preemption phase selector) shall be initially programmed by the Contractor based on information contained on the plans.



***Note: Three bound sets of hard copy programming per device shall be supplied to the Town by the CONTRACTOR.***

Upon final acceptance of the signal by MassDOT, the CONTRACTOR shall supply 8½"x11" or 11"x17" laminated copy of the traffic signal design plan and sequence and timing chart to be left in the cabinet documentation envelope mounted on the inside of the cabinet door.

#### EXISTING INSTALLATION

The existing signal installations shall be maintained in operation throughout the construction period and until the new signal system is ready for operation. The contractor may install temporary supports for signal heads as necessary to allow for construction activities. Any temporary installation shall be in conformance with the 2009 MUTCD in every case. If an existing signal is to be turned off temporarily to allow controller switchover or requiring temporary turn-off, a police detail shall be used to control traffic at the intersection until stop-and-go operation is restored.

Old cable and unusable materials shall be disposed of by the Contractor.

#### AS-BUILT TRAFFIC LAYOUT PLANS AND SIGNAL PERMIT

It will be the responsibility of the contractor to provide As-Built traffic signal layout plans and/or Traffic Signal Permit, indicating all signal equipment, detectors, conduits, pullbox, complete with as-built timing and sequence, major item list, power-pole number and meter number. The Contractor shall provide the final As-Built/Permit Plan in hard copy and electronic AUTOCAD files to MassDOT District 3 Traffic Engineer prior to the Final Acceptance of the signal system. If desired, the Contractor may hire an ENGINEER or the DESIGN ENGINEER for a fee for preparing the Traffic Signal Permit and electronic version. These plans shall also be delivered to the Town of Northborough prior to the final acceptance of the project.

#### COMPENSATION

Work under Item and 816.01 will be paid for at the respective Contract unit prices per Lump Sum, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for the maintenance of existing signal installations during construction, but all costs in connection therewith shall be included in the Contract unit price bid.

Conduit will be paid for separately under 3 Inch Electrical Conduit, Item 804.3. Pull boxes shall be paid for separately under Pull Box 12 x 12 Inches, Item 811.31.

**ITEM 816.80****TRAFFIC CONTROL**  
**SIGNAL REMOVED AND STACKED****LUMP SUM**

The work under this item shall conform to the relevant provision of Section 815 of the Standard Specifications and the following:

The work shall include the removal, transporting and stacking, as directed by the Engineer, of existing traffic signal equipment at the intersection of Route 27 (Acton Road) and Route 225 (Westford Street) in the Town of Westford.

The individual items of work shall include but not necessarily be limited to: removing, transporting and stacking existing traffic signal equipment including the removal and disposal of their foundations and electrical system; removing and disposing or abandoning existing hand holes and signal conduit; disconnecting the power source; removing the riser on the utility pole.

The existing mast arms and ground-mount signal poles shall be retained and reused.

All signal heads, LED modules, backplates and visors; controller cabinet with internal components; and pullbox frames and grates shall be carefully removed, and with prior approval of the Engineer, transported and stacked at the Westford Highway Department, 28 North Street, Westford, MA, 01886. If the Westford Highway Department determines any equipment is not acceptable, it shall become the property of the Contractor for disposal off site at no additional cost.

Old cable and all unusable material, as determined by the Engineer, shall be disposed of by the Contractor.

The work shall also include the excavation and backfilling with compacted gravel of the holes resulting from the excavation of the foundations and the replacement, in kind, of any surface material disturbed.

**COMPENSATION**

Traffic control signal removed and stacked will be paid for at the Contract unit price per Lump Sum, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for dismantling, loading, transporting, and stacking of the traffic control signals as designated above, the excavation and disposal of the existing foundations, the supplying and replacing of compacted gravel backfill and restoration or replacement, in kind, of the area where foundations and posts are removed, but all costs in connection therewith shall be included in the Contract unit price bid.

<b><u>ITEM 824.01</u></b>	<b><u>RECTANGULAR RAPID-FLASH BEACONS,</u></b> <b><u>LOCATION NO. 1</u></b>	<b><u>LUMP SUM</u></b>
<b><u>ITEM 824.02</u></b>	<b><u>RECTANGULAR RAPID-FLASH BEACONS,</u></b> <b><u>LOCATION NO. 2</u></b>	<b><u>LUMP SUM</u></b>
<b><u>ITEM 824.03</u></b>	<b><u>RECTANGULAR RAPID-FLASH BEACONS,</u></b> <b><u>LOCATION NO. 3</u></b>	<b><u>LUMP SUM</u></b>
<b><u>ITEM 824.04</u></b>	<b><u>RECTANGULAR RAPID-FLASH BEACONS,</u></b> <b><u>LOCATION NO. 4</u></b>	<b><u>LUMP SUM</u></b>
<b><u>ITEM 824.05</u></b>	<b><u>RECTANGULAR RAPID-FLASH BEACONS,</u></b> <b><u>LOCATION NO. 5</u></b>	<b><u>LUMP SUM</u></b>

*Location No. 1: Bike Trail at Main St (Rte 27) Northern*

*Location No. 2: Bike Trail at Main St (Rte 27) Southern*

*Location No. 3: Bike Trail at Brook St*

*Location No. 4: Bike Trail at Concord Rd*

*Location No. 5: Bike Trail at Wetherbee St*

#### **DESCRIPTION**

The work under these items shall conform to the relevant provisions of Section 824 of the Standard Specifications and the following. The work shall include furnishing and installing solar powered rectangular rapid-flash beacons (RRFB) at the locations indicated on the plans or where directed by the Engineer. All work shall be in accordance with MassDOT Standard Specifications and as shown on the plans and in the special note for these item numbers.

#### **GENERAL REQUIREMENTS**

Each RRFB shall consist of two rapidly and alternately flashing rectangular yellow indications having LED array based pulsing light sources, and shall be designed, located, and operated with the detailed requirements specified on the plans.

Each RRFB shall be a complete assembly, consisting of supporting structure (pole, breakaway transformer base, sign supports), indications and electrical components (wiring, solid-state circuit boards, etc).

The designated warning signs shall be paid under Item 832.

#### **FUNCTIONAL REQUIREMENTS**

Each RRFB shall require solar power.

Each RRFB shall be activated by push button.

Each RRFB shall be ADA compliant.

The RRFB shall be normally dark, shall initiate operation only upon pedestrian actuation, and shall cease operation after a predetermined time limit (based on MUTCD procedures). The time limits are listed on the plans for each RRFB system.

A small light directed at, and visible to, pedestrians in the crosswalk shall be installed integral to the RRFB to give confirmation that the RRFB is in operation.

When activated, the RRFB indications shall flash in a rapidly alternating “wigwag” flashing sequence (left light on, then right light on).

Each of the RRFB’s indications shall have 70 to 80 periods of flashing per minute.

### MECHANICAL CONSTRUCTION REQUIREMENTS

Each RRFB indication shall be a minimum size of approximately 5” wide x 2” high.

The two RRFB indications shall be aligned horizontally, with the longer dimension of the indication horizontal, and a minimum space between the two indications of approximately 7” measured from inside edge of one indication to inside edge of second indication.

The outside edges of the two indications, including any housing, shall not protrude beyond the outside edges of the integral signage of the RRFB.

The light intensity of the RRFB’s indications shall meet the minimum specifications of the Society of Automotive Engineers (SAE) standard 1595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005.

The supporting structure of the RRFB (breakaway transformer base, post, sign holders, etc) shall be constructed of manufactured aluminum embodiments.

Each RRFB is to be supplied with all required hardware to install assembly.

Each RRFB shall be located between the bottom of the crossing warning sign and the top of the supplemental downward diagonal arrow or “AHEAD” plaque.

Each RRFBs associated with a given crosswalk (including those with an advance crossing sign, if used) shall, when activated, simultaneously commence operation of their alternating rapid flashing indication and shall cease operation simultaneously.

### ENVIRONMENTAL OPERATIONS

The pushbutton shall be capable of continuous operation over a temperature range of -30 degrees F to 165 degrees F (-34 degrees C to 74 degrees C).

### COMPENSATION

The RRFB will be paid for at the Contract unit prices per Lump Sum, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 832.1****TRAIL RULES SIGN****EACH**

Work to be done under this Item shall conform to the relevant provisions of Section 828, "Traffic Signs" of the Standard Specifications for Highways and Bridges and the following:

The sign in this category shall be fabricated with M9.30.0 - Type III High Intensity Encapsulated Lens or Type IV High Intensity Non-Metalized Prismatic Lens Reflective Sheeting. Legend type shall be either Type C or Type D.

The sign shall have a white background with black lettering, shall be 24in x 36in and shall include the following text:

BRUCE FREEMAN RAIL TRAIL

Guidelines for Sharing the Path

Hours of Operation:

*One Half Hour Before Sunrise to One Half Hour After Sunset*

**General Guidelines**

1. EVERYONE: KEEP TO THE RIGHT except to pass.
2. Pass on the left, only when safe.
3. Give an audible warning before passing.
4. Yield to emergency and maintenance vehicles.
5. Maximum Speed: 15 MPH

**Bicycling**

- Helmets are recommended for all cyclists and required by state law for children under 13.
- Stop your bicycle, if necessary, to yield or to prevent an accident.
- Bicyclists must yield to pedestrians.
- Bicyclists may ride a maximum of two-abreast only when safe

**Walking / Jogging**

- Keep to the right when walking or running on the path.
- Look before entering the bikeway or changing direction.
- Don't walk or run more than two abreast.

**In-Line Skating**

- Helmets, kneepads, and wristguards are advised.
- Keep to the right so that other users may pass safely.
- Skate single-file when the bikeway is busy.

**Common Courtesy**

- Do not litter or trespass on private property.
- Keep your dog on a leash (Maximum 6 Feet). Pick up after your dog.
- Respect other bikeway users. Share the path.

**COMPENSATION**

Measurement for Item 832.1, Trail Rules Sign, will be per each, complete in place.

Payment for Item 832.1 will be at the Contract unit price per each sign panel in place and will include without additional compensation all hardware, brackets, bolts, labor, materials, excavation, transportation, etc. necessary to complete the above work.

**ITEM 832.2****NARA PARK RULES SIGN****EACH**

Work to be done under this Item shall conform to the relevant provisions of Section 828, "Traffic Signs" of the Standard Specifications for Highways and Bridges and the following:

The sign in this category shall be fabricated with M9.30.0 - Type III High Intensity Encapsulated Lens or Type IV High Intensity Non-Metalized Prismatic Lens Reflective Sheeting. Legend type shall be either Type C or Type D.

The sign shall have a white background with black lettering, shall be 24in x 36in and shall include the following text:

**NARA PARK RULES**

1. Park open dawn to dusk.
2. Dogs must be leashed (6' max length).
3. Please pick up after your dog. Throw waste in trash barrel.
4. No alcohol permitted anywhere in the park or Acton trails.
5. Massachusetts Fishing License Required ([www.massfishhunt.com](http://www.massfishhunt.com))
6. Swimming in designated "swim area" only.
7. Boat use prohibited when beach is closed.
8. Call 911 in case of emergency; report suspicious activity.
9. For more information visit [www.acton-ma.gov](http://www.acton-ma.gov) or call 978-929-6640.

**COMPENSATION**

Measurement for Item 832.2, Trail Rules Sign, will be per each, complete in place.

Payment for Item 832.2 will be at the Contract unit price per each sign panel in place and will include without additional compensation one P-5 post, all hardware, brackets, bolts, labor, materials, excavation, transportation, etc. necessary to complete the above work.

**ITEM 874.45****TRAFFIC SIGN REMOVED AND DISCARDED****EACH**

Work under this Section shall conform to the applicable provisions of Section 828 of the Standard Specifications and the following:

**GENERAL**

The work shall consist of removing and discarding existing regulatory, warning and directional signs and supports not required for reuse on this project.

**CONSTRUCTION**

The supports and existing foundations shall be removed to a depth of at least 6" below the existing ground and the holes backfilled with gravel. The surface shall be patched with a material to match the existing ground or as directed by the Engineer. The signs and supports shall become the property of the Contractor and the Contractor shall legally dispose of the items at a location not on MassDOT Highway Division property.

If signs are attached to existing light poles, utility poles or traffic poles, only the sign and attached hardware shall be removed and discarded.

### COMPENSATION

Traffic sign removed and discarded will be measured for payment by the each.

Traffic sign removed and discarded will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for dismantling, loading, transporting and discarding of the signs and supports as designated above, the excavation and disposal of the existing foundation and the supplying and placing of compacted gravel backfill where foundations and posts are removed, and the patching of the existing surface, but all costs in connection therewith shall be included in the Contract unit price bid.

### ITEM 874.75      MISCELLANEOUS SIGN REMOVED AND RESET      EACH

The work shall include removing and resetting existing trackside signage and posts related to the operation of the railroad.

The sign, composed of a heavy duty steel rail, has an attached wood or steel horizontal member. All attempts shall be made to remove the sign and horizontal member intact. The burial depth of the post and direction and orientation of the horizontal member shall be noted. Existing foundations shall be removed to a depth of at least 6in below the existing ground and the holes backfilled with gravel. The surface shall be patched with a material to match the existing ground or as directed by the Engineer.

The sign shall be stored in a secure location and reset at the location shown in the plans. The sign shall be placed at the same orientation and to the depth noted during removal.

Signs, attachment hardware and sign support posts lost, damaged or otherwise made unsuitable for reuse while being removed, transported, stored or reset shall be replaced with new material at no additional cost. New attachment hardware shall be furnished and installed as necessary to replace any missing or unusable existing hardware.

### COMPENSATION

Miscellaneous sign removed and reset will be measured for payment by the each, complete in place.

Miscellaneous sign removed and reset will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 880.1****RELOCATION OF POWERS GALLERY  
ELECTRIC OUTLET****LUMP SUM****DESCRIPTION**

Work under this item consists of removing and resetting of a privately owned and maintained metal pole with electric outlet and restoring underground electrical connections to the relocated outlet as directed by the Engineer. The location of the existing outlet is at approx. Sta. 51+10 RT on the proposed 8' hot mix asphalt path to Great Road. The path is located at approximately Station 227+25, LT off the trail.

Prior to commencing the work called for under this Item, the Contractor shall schedule a meeting with the Engineer, the Owner of the lighting facility or the Owner's representative, to review the procedures and materials the Contractor intends to use in the work.

The Contractor shall cooperate with the Owner with respect to the electrical materials and installation methods to be used. However, any requested work that falls outside the scope or intent of the Plans and/or these Specifications, as determined by the Engineer, will not be performed under this item as bid. The Contractor may negotiate with the Owner for additional compensation for all extra work, subject to the approval of the Engineer.

**CONSTRUCTION METHODS**

The major items required to perform this work are:

- 50mm Electrical Conduit, Type NM-Plastic (UL)
- Electrical Cable MHD Type 7 conforming to Materials Subsection M8.16.7
- Metal Pole and Outlet Removed and Reset - the intent of this work is to remove the existing metal pole with outlet and reposition it. The Contractor shall be responsible for providing all incidental hardware that may be required to complete the relocation work.

All work to be performed under this item shall be carried out so that there is minimum conflict with the proposed conduit, pipes and structures installed under other items of this Project.

The final location shall be field verified, and the Contractor shall cooperate with the Owner when determining the location.

All work requested by the Owner, which the Engineer terms as extra work shall be separately negotiated between the Owner and the Contractor and in such a manner that will not cause any delays in the scheduled work required in this contract.



The existing equipment shall not be removed until the Engineer so directs that this phase of work can commence. When removing the designated pole with the outlet, the Contractor shall take all precautions to avoid damaging materials involved. It shall be moved as a complete unit, whenever practicable. If code requirements or safety precautions require that it be dismantled into separate units, the Contractor shall adequately mark each piece so that matching pieces can be properly reassembled in the new location. Any piece not scheduled for immediate reinstallation shall be safely stored by the Contractor in a designated location, and the Contractor will be responsible for its safekeeping. The Contractor shall salvage all fasteners such as nuts, bolts, screws, wiring and other incidental hardware for reuse.

The Contractor shall take all precautions necessary to protect the metal pole with outlet and hardware from damage during this relocation work. The Contractor shall repair any damage caused by his operations or shall replace any components damaged beyond repair, all without compensation.

The proposed conduit shall be installed in accordance with the relevant provisions of Subsections 801.60. The conduit shall be connected to the sweeps in a manner acceptable to the Engineer and all applicable NEC/MEC codes concerning this type of installation.

Prior to reinstallation, the metal pole with outlet shall be cleaned of all excess cement, mortar or other deleterious material.

The pole shall be plumbed and positioned.

All electrical wiring work performed under this item will conform to the relevant NEC/MEC provisions covering this item.

Upon completion of the installation, the Contractor shall perform all tests required to ensure that the outlet performs to the satisfaction of both the Engineer and the Owner. The contractor shall make all adjustments necessary to attain such approval.

### COMPENSATION

Relocation of Powers Gallery electric outlet will be paid for at the contract lump sum price, which price shall include full compensation for all labor, materials equipment and incidental costs required to complete the work.

Work performed by the Contractor at the Owner's request, but which the Engineer determines is outside the scope of this Item, will be paid for under a separate agreement between the Contractor and the Owner, subject to the Engineer's approval.

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**ITEM 904.4**                      **4000 PSI, ¾ IN., 585 HP CEMENT CONCRETE**                      **CUBIC YARD**

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The work to be performed under this item shall conform to the relevant provisions of Subsection 901 of the Supplemental Specifications and the following:

4000 PSI, ¾ IN., 585 HP Cement Concrete shall be used to construct the cast-in-place deck slab, curb and at those areas designated by the Engineer, and/or as designated on the Plans.

4000 PSI, ¾ IN., 585 HP Cement Concrete shall conform to all material requirements contained in Subsection M4.06.1 of the Supplemental Specifications, with the exception of cementitious content, which shall be limited to a maximum of 585 pounds per cubic yard.

At least 30 calendar days prior to the proposed start of placing the concrete bridge deck, the Contractor shall submit to the Engineer for approval, a submission (herein called the Placement and Curing Plan) specifying the method of concrete conveyance, placement, type and number of finishing machines and work bridges, rate of pour, estimated time of completion, screed and rail erection plan, sequence of concrete pours, and the concrete curing procedure. The Placement and Curing Plan shall take into consideration weather conditions. It shall also include details and a complete description of equipment to be used in the handling, placement, finishing and curing the concrete including the number and type of personnel who will be engaged in the operation. The personnel shall consist exclusively of persons with the experience and skill appropriate to their working assignment. Approval of this plan will not relieve the Contractor of the responsibility for the satisfactory performance of his/her methods and equipment. The Placement and Curing Plan shall include, but not be limited to, the following:

1. Proof of the following minimum operator qualifications for the bridge deck finishing machine(s):
  - a. Five years experience operating machines or similar type and manufacturer as that proposed.
  - b. Proof of no less than five bridge decks of similar size, placed using a machine of the same manufacturer as that proposed.Or, as a substitute for a. and b.:
  - b. A representative of the manufacturer of the bridge deck finishing machine shall be present on the site a minimum of 24 hours in advance of the proposed deck placement to approve the set up of the machine and rail system, and the representative shall be present for the entire duration of the placement of the deck concrete using the bridge deck finishing machine.
2. Provisions for consolidation of cement concrete. At least one vibrator shall be in service per each 30 cubic yards per hour of cement concrete placed with at least 2 vibrators in service at all times.
3. Curing method. At least two workers shall continuously place wet burlap curing materials from a dedicated work bridge from the start of the deck placement until the deck is completely covered with wet burlap.
4. When cold weather is reasonably expected during the 14 day wet curing period, or has occurred within 7 days of anticipated concrete placement, the Contractor shall include detailed procedures for the production, transporting, placing, provisions for enclosures, protecting, curing, and temperature monitoring of concrete during cold weather, including a plan of heating devices, types and locations around structure.

5. Method of monitoring temperature of hardened concrete. The method of monitoring concrete temperatures shall be submitted regardless of whether cold weather is expected during the 14 day wet cure period.
6. Letter certifying that the fogging equipment attached to the finishing machine produces atomized water droplets with an average droplet diameter of 0.003 inches or less that are uniformly distributed at a rate of at least 0.10 gallons/square foot/hour.
7. Backup systems as required.

Before concrete placement operations begin, the Contractor shall make all necessary arrangements and have all materials on hand for curing and protecting the concrete deck. Concrete placement shall not proceed until the Engineer is satisfied that all necessary steps have been taken to insure adequate compliance with these Specifications and that completion of the operation can be accomplished within the required scheduled time. It shall be the Contractor's responsibility to allow sufficient time to permit such an inspection by the Engineer.

A pre-placement meeting shall be held between the Contractor and the Engineer at least 2 weeks prior to the start of any concrete placement for the deck slab. The Contractor and the Engineer shall review all aspects of the proposed deck slab concrete placement, as documented in the approved Placement and Curing Plan, including, but not limited to, the following:

- Equipment proposed for use and for back-up;
- Planned workforce and assigned tasks of each designated position, based on experience and expertise;
- Proposed construction techniques;
- Safety considerations;
- Concrete mix design;
- Admixtures and performance data; dosage rates shall be as approved;
- Proposed placement rate, provisions for adverse weather, curing and loading schedules;
- Curing Practices to be employed as well as the workforce designated to the curing process;
- Delivery / conveyance equipment, including deck finishing machine setup and operation;
- Traffic control.

No concrete shall be placed until the Engineer approves all aspects of the proposed placement. Modifications must be submitted in writing to the Engineer for approval. No concrete shall be placed until the environmental conditions are deemed favorable and satisfactory means to mitigate adverse environmental conditions exist. Favorable environmental conditions are defined as an expected weather forecast suitable for concrete placement during the entire placement duration with an the evaporation rate not to exceed 0.15 lbs./ft<sup>2</sup>/hr, or suitable equipment and appropriate actions are taken, as approved by the Engineer, to limit the evaporation rate of the exposed concrete surface to less than 0.15 lb/ft<sup>2</sup>/hr and acceptable curing temperatures are expected for the duration of the curing period.

The Contractor shall provide any necessary means to mitigate adverse weather conditions and curing temperatures with the approval of the Engineer. Failure to maintain acceptable environmental conditions will result in the concrete placement being stopped and a bulkhead put in place. Concrete temperature will be taken from the same sample used for slump and air content tests. These measurements will be taken prior to commencement of concrete placement. If, in the Engineer's opinion, significant changes occur in atmospheric conditions, additional atmospheric measurements and calculations by the Contractor will be required. The Contractor will supply all instruments necessary to make the required calculations, will perform the tests in the presence of the Engineer, and will document the results on the attached "Bridge Deck Placement Environment" table which shall be given to the Engineer for approval and incorporation in the contract document files.

A trial placement of at least 3 cubic yards using the approved HP Cement Concrete mix design shall be required a minimum of two weeks before the intended date of the deck slab placement. The Contractor will be required to demonstrate proper mix design, batching, placement, finishing and curing of the HP Cement Concrete deck slab. The trial placement shall simulate the actual job conditions in all respects including plant conditions, transit equipment, travel conditions, admixtures, forming, placement equipment, and personnel. If there are problems, the Engineer may require the Contractor to conduct more trial batches and trial placements. Removal of the trial placement concrete from the job site is the responsibility of the Contractor.

In addition to the requirements contained herein, all weather and concrete temperature requirements contained in Subsection 901.64 shall be satisfied. Cement concrete for bridge decks shall not be placed when the ambient air temperature exceeds 85°F or is expected to exceed 85°F during the placement of the deck. When placing concrete, the Contractor must provide suitable equipment and take appropriate actions as approved by the Engineer to limit the evaporation rate of the exposed concrete surface to less than 0.15 lb/ft<sup>2</sup>/hr. The deck surface evaporation rate shall be determined in accordance with Figure 1 of these Specifications (obtained from "Plastic Cracking of Concrete" by Delmar Bloem for the National Ready Mixed Concrete Association and published in ACI 305R-89) and all data contained in the Bridge Deck Placement Environment table below shall be determined by the Contractor and agreed upon by the Engineer prior to and after casting the bridge deck. To maintain the deck surface evaporation rate below 0.15 lb/ft<sup>2</sup>/hr the Contractor shall take one or more of the following actions:

1. Misting the surface of the concrete with pressurized equipment attached to the finishing machine until the curing cover is applied. The water mist shall be distributed at a rate of at least 0.10 gallons/square foot/hour. For example, on a deck that is 30 feet wide, the system must be able to apply at least 3.0 gallons of water per linear foot per hour. The fog spray must be produced from nozzles that produce a atomized fog mist that will maintain a sheen of moisture on the concrete surface without ponding. The atomized water droplets shall have an average droplet diameter of 0.003 inches or less. The area of coverage from each nozzle shall overlap all adjacent coverage areas by at least 12 inches. Water that drips from the nozzles shall not be allowed to fall onto the concrete that is being cured.
2. Reduce the temperature of the concrete.
3. Reschedule the placement until such time as the environmental conditions are acceptable, such as at night or during early morning hours.

Bridge Deck Placement Environment						
City/Town:				Date:		
Bridge Number:				Contract Number:		
Start Station:				End Station:		
X	Time Measured	Air Temp.	Relative Humidity (%)	Concrete Temp.	Wind Velocity	Rate Evaporation
Prior to Casting						
After Casting						
Signature - Contractor's Authorized Representative:				Printed Name:		
Signature - MHD Resident Engineer:				Printed Name:		

## CEMENT CONCRETE CRACK SEALING

Cement Concrete crack sealing requirements defined herein are for the repair and sealing of cast-in-place cement concrete to prevent water infiltration to the steel reinforcement bars. The width of cracks shall be determined by the Engineer using a width indicating comparator card made of clear plastic with lines of specified width on the cards. The crack width comparator cards shall be held on concrete surfaces to allow the widths of any concrete cracks to be determined by direct visual comparison of the crack width with the widths of the lines marked on the card surface. These cracks are assumed to be non-moving and to have been caused by inadequate control of shrinkage or temperature stresses during curing. Cracks that are of structural concern shall be repaired by other methods determined by the Engineer. All required crack sealing and crack repairs shall be performed by the Contractor without additional compensation. The Contractor shall be required to seal cracks even if the environmental conditions during placement and curing satisfied specification requirements.

Cracks shall be sealed after construction movement is substantially stable and before waterproofing, pavement, or other construction covers the cracked surface. Crack sealing materials shall be applied by skilled applicators under a supervisor with proven successful experience in applications with similar scope of work. Crack sealing materials shall be applied when the concrete and the ambient air temperatures are above 40°F. If a heated enclosure is used to accomplish this, the heating units shall be properly vented to the outside of the enclosure to prevent products of combustion from exhausting within the enclosure.

Before containers of sealing materials are opened, the labels shall be checked and the label information shall be documented. If multi-component systems are used, mixing shall be completed prior to application. Manufacturer's instructions shall be followed. An initial crack sealing demonstration application shall be satisfactorily made in the presence of the Engineer before the application is continued.

Before sealing, the concrete must be clean, sound, and free of contaminants and surface moisture. Any curing compounds, sealers, oils, greases, coatings, or other impregnations shall be removed by abrasive blast cleaning. Once any concrete surface contaminants are removed, the concrete shall be swept clean and blown off using oil-free compressed air immediately prior to applying the sealer.

Methacrylate crack sealing shall be performed in accordance with the manufacturer's instructions within the allowable ambient temperature range. The cracks shall be v-notched to a minimum depth of ½" and shall be cleaned with oil-free compressed air. The notch shall then be inspected to confirm that the crack was intercepted. If the crack was not intercepted, the notch shall be expanded to intercept the crack and shall then be re-cleaned with oil-free compressed air. Methacrylate shall then be poured into the crack. The crack shall then be observed for seepage of methacrylate and shall be refilled as necessary to ensure the crack is completely filled. If large quantities of methacrylate are used and the crack is not getting filled, the crack should be filled with pre-bagged dried silica sand filler and the crack shall then be re-filled with methacrylate. Methacrylate crack sealer shall consist of a high molecular weight low viscosity methacrylate monomer that when catalyzed will produce a crack-healer/penetrating-sealer that is a rapidcuring, modified-methacrylate resin. The methacrylate material shall, as a minimum, provide the following as applied properties:

Property	Value	Test
Viscosity	< 25 cps	ASTM D2393-86
Bond Strength	> 1500 psi	ASTM C882
Tensile Elongation	>3%	ASTM D638

In addition, the methacrylate material shall demonstrate full penetration of concrete cracks in mock-up testing. Mock-up testing shall consist of preparing the deck surface, applying the methacrylate sealer, and removing cores to evaluate the depth and quality of methacrylate sealer penetration. Successful methacrylate penetration of the concrete cracks shall be demonstrated visually in nominal 3 inch deep cores that intersect crack widths in the 7 to 20 mil width range. The cores shall be sliced longitudinally, perpendicular to the crack, and examined in an AASHTO accredited laboratory using ultraviolet light in order to fluoresce the methacrylate to determine the methacrylate penetration depth (the deepest point to which the methacrylate reached) and the sealer-filled crack depth (the depth to which the crack was filled wall-to-wall). The results of mock-up testing shall be documented in a report prepared by the AASHTO accredited laboratory.

Epoxy injection crack sealing shall be performed in accordance with the manufacturer's instructions within the allowable ambient temperature range. Epoxy-Resin for Cement Concrete Crack Injection shall conform to AASHTO M235, Type IV, Grade I. The cracks shall be cleaned with compressed air. Surface mounted injection ports shall then be installed over the centers of the cracks. The spacing of these ports shall be contingent upon the material and the injection equipment chosen. Socket porting shall be allowed provided that a hollow drill bit and vacuum system is used to prevent debris from entering the cracks. Surface ports shall be mounted with rapid setting epoxy material. The crack widths shall be noted during port installation. After the ports are installed, the crack surfaces shall be sealed with high modulus, 100% solids, moisture tolerant epoxy paste adhesive. This material shall be capped with fine sand before it is cured. After the capping material has cured, the cracks shall be injected with an epoxy resin compound. The injection pressure used to seal the cracks shall be based upon a number of factors including crack width, crack depth, and the epoxy material used. Injection shall be accomplished using a metered system. The system shall be equipped with a pressure gauge accurate for the pressures anticipated for this work. Injection shall start at the widest point of the crack and shall continue until the narrowest portions of the crack have been filled. Injection shall continue until refusal. If epoxy is observed at adjacent ports, the adjacent port shall be capped and injection shall continue until refusal occurs. Once refusal occurs, injection shall continue at the next wet port until refusal is reached.

Silane Crack Sealer shall consist of a clear, breathable, high-performance, 100 percent solids by weight Silane sealer for protecting new and existing concrete surfaces. It must penetrate deeply, sealing out water, chloride ions, and acids, and prevent damage from freeze/thaw cycles. Silane Crack Sealer material shall, as a minimum, provide the following as applied properties:

Property	Value	Test
Water Weight Gain at 250 ft <sup>2</sup> /gal	88 percent reduction	NCHRP 244 Series II-Cube test
Absorbed Chloride at 250 ft <sup>2</sup> /gal	89 percent reduction	NCHRP 244 Series II-Cube test
Absorbed Chloride at 250 ft <sup>2</sup> /gal	94 percent reduction	NCHRP 244 Series IV - Northern Climate

The type of Cement Concrete crack sealing required shall be determined as a function of the surface type and maximum crack width as follows:

Bridge decks, either with membrane waterproofing and hot mix asphalt wearing surface or left exposed, and other non-overhead surfaces sloped less than or equal to 15%:

- Cracks less than 0.006" wide shall be ignored;
- Cracks greater than or equal to 0.006" wide and less than 0.012" wide shall be sealed with an approved methacrylate;
- Cracks greater than or equal to 0.012" wide shall be sealed using either epoxy injection or methacrylate with a sand filler.

Overhead surfaces, vertical surfaces, and non-overhead surfaces sloped greater than 15%:

- Cracks less than 0.006" wide shall be ignored;
- Cracks greater than or equal to 0.006" wide and less than 0.016" wide shall be sealed with an approved silane sealer;"
- Cracks greater than or equal to 0.016" wide shall be sealed using epoxy injection.

**ITEM 910.****STEEL REINFORCEMENT FOR STRUCTURES****LB**

The work to be performed under this item shall conform to the requirements of Subsection M8.01 of the MassDOT Standard Specifications and the following:

Steel Reinforcement for Structures, Item 910. shall include all costs associated with the steel reinforcing bars as well as the welded wire fabric as specified on the contract drawings.

**COMPENSATION**

Steel reinforcement for structures will be measured for payment by the pound (lb), based upon the limits shown on the Plans and as defined by the Engineer, complete in place.

Steel reinforcement for structures will be paid for at the contract unit price per pound (lb), which price shall include full compensation for all labor, materials, equipment and incidental costs required to complete the work.

**ITEM 950.1****TEMPORARY SHORING****LUMP SUM**

The work to be done under this Item shall conform to the applicable provisions of Section 140 and 950 of the Standard Specifications except where specifically amended herein.

Temporary shoring systems, supplied by the contractor, shall be installed at approximately the locations as indicated on the contract plans. The exact layout and location of the systems may be altered as necessary to accommodate specific site conditions and contractor operations. The Contractor shall accurately locate all utilities lines and structures to ensure that the proposed temporary shoring systems will not interfere with any existing or proposed utilities and structures.

All permanent and temporary shoring that protrudes into the soil that supports the bridge structure shall be left in place. Supporting soil shall be defined as all soil directly below the footing contained within a series of planes that originate at the perimeter of the bottom of the footing and project down and away from the footing at an angle of 45 degrees from the horizontal. No additional payment will be made for any shoring left in place.

Shoring associated with the MSE wall construction may be removed, provided that the shoring is removed prior to the MSE wall being constructed to a height greater than 5 feet above the adjacent proposed finished grade. Removal of the support of excavation will only be allowed upon submittal of a procedure to the Engineer for approval. The procedure shall outline how the support of excavation will be removed without disturbing the underlying soils that support the MSE wall system.



The design of the temporary shoring systems shall adequately resist all loads applied to the systems for the duration of construction until the excavation is safely backfilled. Loads acting on the systems include, but are not limited to, earth and/or water pressure, construction live loads, live loads from staged traffic, and adjacent bridge structure loads. The design shall be in accordance with the latest LRFD bridge design specifications, of the American Association of State Highway and Transportation Officials (AASHTO) and the AASHTO Guide Design Specification for Bridge Temporary Works, 1995, and all interims published as of bid opening

The Contractor shall submit calculations and detailed drawings of the proposed temporary shoring systems to the Engineer for approval. These calculations and drawings shall be stamped by a Professional Engineer registered in the Commonwealth of Massachusetts.

### **BASIS OF PAYMENT**

Temporary shoring will be paid for at the Contract unit price per lump sum, which price shall include all labor, materials, equipment and incidental costs required to complete the work. 50% of the lump sum value shall be paid upon completion of installation of shoring. The remaining 50% shall be paid upon satisfactory removal of shoring.

Each system location will not be measured and paid for separately. This item is one payment for all systems required on the project.

### **ITEM 991.1 CONTROL OF WATER – STRUCTURE NO. A-02-014 (A5T) LUMP SUM**

The work to be performed under this item shall include all pumping, sandbagging, and other measures necessary for sufficient water control to accomplish installation of the Mechanically Stabilized Earth wall and over excavation of soils at the North Abutment in the dry. Furthermore, all water control or dewatering operations shall be in compliance with the approved environmental permits included in these bid documents.

All work areas shall be within the existing right of way and acquired construction easements. Dewatering shall be conducted to ensure that all concrete is placed and cured in the dry.

It is the responsibility of the Contractor to determine the need and extent of dewatering required based on his/her proposed construction methods. Furthermore, the Contractor shall submit methods and materials he proposes to use for the Engineer's approval.

### **CONSTRUCTION**

Plans and calculations (if applicable) for all water control measures shall be developed by the Contractor for this item. These plans and calculations shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts and shall be submitted for the approval of the Engineer prior to the start of construction.

The Contractor shall use such equipment and shall perform his operations in such a manner that disturbances of the soil in the foundation area will be prevented. He shall keep the area being excavated dry by such means that water will be prevented from entering from the adjacent soils.

All dewatering and related earthwork shall be conducted in such a manner as to prevent siltation or contamination of the waterway. The pumping discharge shall not be allowed to enter directly into the waterway. The water from the work areas shall be pumped to a dewatering basin. This basin shall be constructed so as to allow the pumped water to pass through the basin with sediments settling out before outletting. At a minimum, the basin shall be constructed of an earthen berm lined with geotextile fabric and surrounded by staked hay bales / compost filter tubes. The basin shall meet or exceed the following criteria:

- A. The size and location of the basin shall be determined based on the size of the contractors pump and the anticipated flows for the construction of the substructures in the dry.
- B. The outlet/weir of the dewatering basin shall not cause erosion of the surrounding area. An approved method of controlling erosion, such as an erosion control blanket, stone, etc., shall be used at the outlet of the basin.

The Contractor shall maintain the dewatering operations in working condition, including periodic removal of accumulated sediment within the basin, to the satisfaction of the Engineer. The water pump and hoses for dewatering shall be in good working condition and of adequate power and size for the operation.

The contractor shall inspect hay bales/compost filter tubes that surround the outlet daily and shall immediately replace any that are damaged.

Placement of the basin will be as directed by the Engineer due to specific site conditions and staging operations of the Contractor.

Pumping shall be conducted in a manner, which will not adversely affect the excavation.

### BASIS OF PAYMENT

Control of water will be paid for at the Contract lump sum price, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for the removal and disposal of the sediment material collected from the dewatering systems, but all costs in connection therewith shall be included in the Contract unit price bid.

**ITEM 995.01      BRIDGE STRUCTURE, BRIDGE NO. A-02-014 (A5T)      LUMP SUM**

The work under this Item shall conform to the applicable provisions of Section 995 of the Standard Specifications and the specific requirements stipulated below for component parts of the subject Item. For those component parts where no specific requirement is stipulated, the Standard Specifications shall apply, except for payment.

Work under this Item shall include all materials, equipment and labor needed to construct the following:

- concrete bridge deck slab, concrete curb on the bridge, and pedestrian protective screen
- horizontally curved steel beams and diaphragms
- elastomeric bearings
- concrete abutment footings, stems, and backwalls
- concrete piers above grade
- concrete approach slabs
- steel reinforcement
- metal pipe rail and associated in-fill screen.

The work does not include any items listed separately in the proposal. Payment for materials shown on the Plans as being part of this bridge structure or which may be incidental to its construction and are not specifically included for payment under another Item shall be considered incidental to the work performed under this Item and shall be included in the unit price of the component of which they are a part.

**4000 PSI, 1 ½ IN., 565 CEMENT CONCRETE****ABUTMENT MASS CEMENT CONCRETE**

Please note that the abutment breastwall thickness exceeds the 4 foot limit for mass cement concrete placement per Standard Specification Section 901.65.B.1. The standard specifications shall be followed for this placement.

**4000 PSI, ¾ IN., 585 HP CEMENT CONCRETE**

The work to be done under this item shall conform to the relevant provisions of Subsection 901 of the Supplemental Specifications and the following:

4000 PSI, ¾ IN., 585 HP Cement Concrete shall be used to construct the deck slab and at those areas designated by the Engineer, and/or as designated on the Plans.

4000 PSI, ¾ IN., 585 HP Cement Concrete shall conform to all material requirements contained in Subsection M4.06.1 of the Supplemental Specifications, with the exception of cementitious content, which shall be limited to a maximum of 585 pounds per cubic yard.

At least 30 calendar days prior to the proposed start of placing the concrete bridge deck, the Contractor shall submit to the Engineer for approval, a submission (herein called the Placement and Curing Plan) specifying the method of concrete conveyance, placement, type and number of finishing machines and work bridges, rate of pour, estimated time of completion, screed and rail erection plan, sequence of concrete pours, and the concrete curing procedure. The Placement and Curing Plan shall take into consideration weather conditions. It shall also include details and a complete description of equipment to be used in the handling, placement, finishing and curing the concrete including the number and type of personnel who will be engaged in the operation. The personnel shall consist exclusively of persons with the experience and skill appropriate to their working assignment. Approval of this plan will not relieve the Contractor of the responsibility for the satisfactory performance of his/her methods and equipment. The Placement and Curing Plan shall include, but not be limited to, the following:

1. Proof of the following minimum operator qualifications for the bridge deck finishing machine(s):
  - a. Five years experience operating machines or similar type and manufacturer as that proposed.
  - b. Proof of no less than five bridge decks of similar size, placed using a machine of the same manufacturer as that proposed.Or, as a substitute for a. and b.:
  - c. A representative of the manufacturer of the bridge deck finishing machine shall be present on the site a minimum of 24 hours in advance of the proposed deck placement to approve the set up of the machine and rail system, and the representative shall be present for the entire duration of the placement of the deck concrete using the bridge deck finishing machine.
2. Provisions for consolidation of cement concrete. At least one vibrator shall be in service per each 30 cubic yards per hour of cement concrete placed with at least 2 vibrators in service at all times.
3. Curing method. At least two workers shall continuously place wet burlap curing materials from a dedicated work bridge from the start of the deck placement until the deck is completely covered with wet burlap.
4. When cold weather is reasonably expected during the 14 day wet curing period, or has occurred within 7 days of anticipated concrete placement, the Contractor shall include detailed procedures for the production, transporting, placing, provisions for enclosures, protecting, curing, and temperature monitoring of concrete during cold weather, including a plan of heating devices, types and locations around structure.
5. Method of monitoring temperature of hardened concrete. The method of monitoring concrete temperatures shall be submitted regardless of whether cold weather is expected during the 14 day wet cure period.
6. Letter certifying that the fogging equipment attached to the finishing machine produces atomized water droplets with an average droplet diameter of 0.003 inches or less that are uniformly distributed at a rate of at least 0.10 gallons/square foot/hour.
7. Backup systems as required.

Before concrete placement operations begin, the Contractor shall make all necessary arrangements and have all materials on hand for curing and protecting the concrete deck. Concrete placement shall not proceed until the Engineer is satisfied that all necessary steps have been taken to insure adequate compliance with these Specifications and that completion of the operation can be accomplished within the required scheduled time. It shall be the Contractor's responsibility to allow sufficient time to permit such an inspection by the Engineer.

A pre-placement meeting shall be held between the Contractor and the Engineer at least 2 weeks prior to the start of any concrete placement for the deck slab. The Contractor and the Engineer shall review all aspects of the proposed deck slab concrete placement, as documented in the approved Placement and Curing Plan, including, but not limited to, the following:

- Equipment proposed for use and for back-up;
- Planned workforce and assigned tasks of each designated position, based on experience and expertise;
- Proposed construction techniques;
- Safety considerations;
- Concrete mix design;
- Admixtures and performance data; dosage rates shall be as approved;
- Proposed placement rate, provisions for adverse weather, curing and loading schedules;
- Curing Practices to be employed as well as the workforce designated to the curing process;
- Delivery / conveyance equipment, including deck finishing machine setup and operation;
- Traffic control.

No concrete shall be placed until the Engineer approves all aspects of the proposed placement. Modifications must be submitted in writing to the Engineer for approval. No concrete shall be placed until the environmental conditions are deemed favorable and satisfactory means to mitigate adverse environmental conditions exist. Favorable environmental conditions are defined as an expected weather forecast suitable for concrete placement during the entire placement duration with an the evaporation rate not to exceed 0.15 lbs./ft<sup>2</sup>/hr, or suitable equipment and appropriate actions are taken, as approved by the Engineer, to limit the evaporation rate of the exposed concrete surface to less than 0.15 lb/ft<sup>2</sup>/hr and acceptable curing temperatures are expected for the duration of the curing period.

The Contractor shall provide any necessary means to mitigate adverse weather conditions and curing temperatures with the approval of the Engineer. Failure to maintain acceptable environmental conditions will result in the concrete placement being stopped and a bulkhead put in place. Concrete temperature will be taken from the same sample used for slump and air content tests. These measurements will be taken prior to commencement of concrete placement. If, in the Engineer's opinion, significant changes occur in atmospheric conditions, additional atmospheric measurements and calculations by the Contractor will be required. The Contractor will supply all instruments necessary to make the required calculations, will perform the tests in the presence of the Engineer, and will document the results on the attached "Bridge Deck Placement Environment" table which shall be given to the Engineer for approval and incorporation in the contract document files.

A trial placement of at least 3 cubic yards using the approved HP Cement Concrete mix design shall be required a minimum of two weeks before the intended date of the deck slab placement. The Contractor will be required to demonstrate proper mix design, batching, placement, finishing and curing of the HP Cement Concrete deck slab. The trial placement shall simulate the actual job conditions in all respects including plant conditions, transit equipment, travel conditions, admixtures, forming, placement equipment, and personnel. If there are problems, the Engineer may require the Contractor to conduct more trial batches and trial placements. Removal of the trial placement concrete from the job site is the responsibility of the Contractor.

In addition to the requirements contained herein, all weather and concrete temperature requirements contained in Subsection 901.64 shall be satisfied. Cement concrete for bridge decks shall not be placed when the ambient air temperature exceeds 85°F or is expected to exceed 85°F during the placement of the deck. When placing concrete, the Contractor must provide suitable equipment and take appropriate actions as approved by the Engineer to limit the evaporation rate of the exposed concrete surface to less than 0.15 lb/ft<sup>2</sup>/hr. The deck surface evaporation rate shall be determined in accordance with Figure 1 of these Specifications (obtained from "Plastic Cracking of Concrete" by Delmar Bloem for the National Ready Mixed Concrete Association and published in ACI 305R-89) and all data contained in the Bridge Deck Placement Environment table below shall be determined by the Contractor and agreed upon by the Engineer prior to and after casting the bridge deck. To maintain the deck surface evaporation rate below 0.15 lb/ft<sup>2</sup>/hr the Contractor shall take one or more of the following actions:

1. Misting the surface of the concrete with pressurized equipment attached to the finishing machine until the curing cover is applied. The water mist shall be distributed at a rate of at least 0.10 gallons/square foot/hour. For example, on a deck that is 30 feet wide, the system must be able to apply at least 3.0 gallons of water per linear foot per hour. The fog spray must be produced from nozzles that produce a atomized fog mist that will maintain a sheen of moisture on the concrete surface without ponding. The atomized water droplets shall have an average droplet diameter of 0.003 inches or less. The area of coverage from each nozzle shall overlap all adjacent coverage areas by at least 12 inches. Water that drips from the nozzles shall not be allowed to fall onto the concrete that is being cured.
2. Reduce the temperature of the concrete.
3. Reschedule the placement until such time as the environmental conditions are acceptable, such as at night or during early morning hours.

Bridge Deck Placement Environment						
City/Town:				Date:		
Bridge Number:				Contract Number:		
Start Station:				End Station:		
X	Time Measured	Air Temp.	Relative Humidity (%)	Concrete Temp.	Wind Velocity	Rate Evaporation
Prior to Casting						
After Casting						
Signature - Contractor's Authorized Representative:				Printed Name:		
Signature - MHD Resident Engineer:				Printed Name:		

## CEMENT CONCRETE CRACK SEALING

Cement Concrete crack sealing requirements defined herein are for the repair and sealing of cast-in-place cement concrete to prevent water infiltration to the steel reinforcement bars. The width of cracks shall be determined by the Engineer using a width indicating comparator card made of clear plastic with lines of specified width on the cards. The crack width comparator cards shall be held on concrete surfaces to allow the widths of any concrete cracks to be determined by direct visual comparison of the crack width with the widths of the lines marked on the card surface. These cracks are assumed to be non-moving and to have been caused by inadequate control of shrinkage or temperature stresses during curing. Cracks that are of structural concern shall be repaired by other methods determined by the Engineer. All required crack sealing and crack repairs shall be performed by the Contractor without additional compensation. The Contractor shall be required to seal cracks even if the environmental conditions during placement and curing satisfied specification requirements.

Cracks shall be sealed after construction movement is substantially stable and before waterproofing, pavement, or other construction covers the cracked surface. Crack sealing materials shall be applied by skilled applicators under a supervisor with proven successful experience in applications with similar scope of work. Crack sealing materials shall be applied when the concrete and the ambient air temperatures are above 40°F. If a heated enclosure is used to accomplish this, the heating units shall be properly vented to the outside of the enclosure to prevent products of combustion from exhausting within the enclosure.

Before containers of sealing materials are opened, the labels shall be checked and the label information shall be documented. If multi-component systems are used, mixing shall be completed prior to application. Manufacturer's instructions shall be followed. An initial crack sealing demonstration application shall be satisfactorily made in the presence of the Engineer before the application is continued.

Before sealing, the concrete must be clean, sound, and free of contaminants and surface moisture. Any curing compounds, sealers, oils, greases, coatings, or other impregnations shall be removed by abrasive blast cleaning. Once any concrete surface contaminants are removed, the concrete shall be swept clean and blown off using oil-free compressed air immediately prior to applying the sealer.

Methacrylate crack sealing shall be performed in accordance with the manufacturer's instructions within the allowable ambient temperature range. The cracks shall be v-notched to a minimum depth of ½" and shall be cleaned with oil-free compressed air. The notch shall then be inspected to confirm that the crack was intercepted. If the crack was not intercepted, the notch shall be expanded to intercept the crack and shall then be re-cleaned with oil-free compressed air. Methacrylate shall then be poured into the crack. The crack shall then be observed for seepage of methacrylate and shall be refilled as necessary to ensure the crack is completely filled. If large quantities of methacrylate are used and the crack is not getting filled, the crack should be filled with pre-bagged dried silica sand filler and the crack shall then be re-filled with methacrylate. Methacrylate crack sealer shall consist of a high molecular weight low viscosity methacrylate monomer that when catalyzed will produce a crack-healer/penetrating-sealer that is a rapid-curing, modified-methacrylate resin. The methacrylate material shall, as a minimum, provide the following as applied properties:

Property	Value	Test
Viscosity	< 25 cps	ASTM D2393-86
Bond Strength	> 1500 psi	ASTM C882
Tensile Elongation	>3%	ASTM D638

In addition, the methacrylate material shall demonstrate full penetration of concrete cracks in mock-up testing. Mock-up testing shall consist of preparing the deck surface, applying the methacrylate sealer, and removing cores to evaluate the depth and quality of methacrylate sealer penetration. Successful methacrylate penetration of the concrete cracks shall be demonstrated visually in nominal 3 inch deep cores that intersect crack widths in the 7 to 20 mil width range. The cores shall be sliced longitudinally, perpendicular to the crack, and examined in an AASHTO accredited laboratory using ultraviolet light in order to fluoresce the methacrylate to determine the methacrylate penetration depth (the deepest point to which the methacrylate reached) and the sealer-filled crack depth (the depth to which the crack was filled wall-to-wall). The results of mock-up testing shall be documented in a report prepared by the AASHTO accredited laboratory.



Epoxy injection crack sealing shall be performed in accordance with the manufacturer's instructions within the allowable ambient temperature range. Epoxy-Resin for Cement Concrete Crack Injection shall conform to AASHTO M235, Type IV, Grade I. The cracks shall be cleaned with compressed air. Surface mounted injection ports shall then be installed over the centers of the cracks. The spacing of these ports shall be contingent upon the material and the injection equipment chosen. Socket porting shall be allowed provided that a hollow drill bit and vacuum system is used to prevent debris from entering the cracks. Surface ports shall be mounted with rapid setting epoxy material. The crack widths shall be noted during port installation. After the ports are installed, the crack surfaces shall be sealed with high modulus, 100% solids, moisture tolerant epoxy paste adhesive. This material shall be capped with fine sand before it is cured. After the capping material has cured, the cracks shall be injected with an epoxy resin compound. The injection pressure used to seal the cracks shall be based upon a number of factors including crack width, crack depth, and the epoxy material used. Injection shall be accomplished using a metered system. The system shall be equipped with a pressure gauge accurate for the pressures anticipated for this work. Injection shall start at the widest point of the crack and shall continue until the narrowest portions of the crack have been filled. Injection shall continue until refusal. If epoxy is observed at adjacent ports, the adjacent port shall be capped and injection shall continue until refusal occurs. Once refusal occurs, injection shall continue at the next wet port until refusal is reached.

Silane Crack Sealer shall consist of a clear, breathable, high-performance, 100 percent solids by weight. Silane sealer for protecting new and existing concrete surfaces. It must penetrate deeply, sealing out water, chloride ions, and acids, and prevent damage from freeze/thaw cycles. Silane Crack Sealer material shall, as a minimum, provide the following as applied properties:

Property	Value	Test
Water Weight Gain at 250 ft <sup>2</sup> /gal	88 percent reduction	NCHRP 244 Series II-Cube test
Absorbed Chloride at 250 ft <sup>2</sup> /gal	89 percent reduction	NCHRP 244 Series II-Cube test
Absorbed Chloride at 250 ft <sup>2</sup> /gal	94 percent reduction	NCHRP 244 Series IV - Northern Climate

The type of Cement Concrete crack sealing required shall be determined as a function of the surface type and maximum crack width as follows:

Bridge decks, either with membrane waterproofing and hot mix asphalt wearing surface or left exposed, and other non-overhead surfaces sloped less than or equal to 15%:

- Cracks less than 0.006" wide shall be ignored;
- Cracks greater than or equal to 0.006" wide and less than 0.012" wide shall be sealed with an approved methacrylate;
- Cracks greater than or equal to 0.012" wide shall be sealed using either epoxy injection or methacrylate with a sand filler.

Overhead surfaces, vertical surfaces, and non-overhead surfaces sloped greater than 15%:

- Cracks less than 0.006" wide shall be ignored;
- Cracks greater than or equal to 0.006" wide and less than 0.016" wide shall be sealed with an approved silane sealer;"
- Cracks greater than or equal to 0.016" wide shall be sealed using epoxy injection.

### **SCHEDULE OF BASIS FOR PARTIAL PAYMENT**

At the time of the bid, the Contractor shall submit on his/her proposal form a schedule of unit prices for the major component Sub-Items that make up Item 995.01 as well as his/her total bridge structure Lump Sum cost for Bridge Structure, Bridge No. A-02-014 (A5T). The bridge structure Lump Sum breakdown quantities provided in the proposal form are estimated and not guaranteed. The total of all partial payments to the Contractor shall equal the Lump Sum contract price regardless of the accuracy of the quantities furnished by the Engineer of the individual bridge components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Item 995.01 and no further compensation will be allowed.

The schedule on the proposal form applies only to Bridge Structure No. A-02-014 (A5T). Payment for similar materials and construction at locations other than at this bridge structure shall not be included under this Item. Sub-Item numbering is presented for information only in coordination with MassDOT Standard Nomenclature.

Sub-Item	Description	Quantity	Unit	Unit Price	Total
660.1	Metal Pipe Rail	420	FT		
901.	4000 PSI, 1.5 IN., 565 Cement Concrete	80	CY		
904.	4000 PSI, ¾ IN., 610 Cement Concrete	5	CY		
904.4	4000 PSI, ¾ IN., 585 HP Cement Concrete	155	CY		
910.1	Steel Reinforcement for Structures - Epoxy Coated	31,020	LB		
910.4	Mechanical Reinforcing Bar Splicer	35	EA		
911.1	Shear Connectors	2,540	EA		
933.	Elastomeric Bridge Bearing Pad	16	EA		

960.1	Structural Steel – Coated Steel	104,920	SY		
965.	Membrane Waterproofing for Bridge Decks	2306	SY		
970.	Bituminous Damp-proofing	40	SY		
971.	Asphaltic Bridge Joint System	32	FT		

**Total Cost of Item 995.01 = \_\_\_\_\_**

**ITEM 995.011 CULVERT STRUCTURE, CULVERT NO. A-02-xxx (xxx) LUMP SUM**

The work under this Item shall conform to the applicable provisions of Section 995 of the Standard Specifications and the specific requirements stipulated below for component parts of the subject Item. For those component parts where no specific requirement is stipulated, the Standard Specifications shall apply, except for payment.

Work under this Item shall include all materials, equipment and labor needed to construct the 6' high by 8' wide precast concrete culvert with a natural substrate bottom that passes under the north MSE wall and connects the two wetlands.

The work does not include any items listed separately in the proposal. Payment for materials shown on the Plans as being part of this culvert structure or which may be incidental to its construction and are not specifically included for payment under another item shall be considered incidental to the work performed under this Item and shall be included in the unit price of the component of which they are a part.

**PRECAST CONCRETE ARCH BRIDGE**

General

This work shall consist of designing, fabricating, and installing a precast concrete culvert and appurtenances. The culvert sections shall conform to the dimensions (span and rise) and geometry shown on the Plans. Reinforcement steel will be paid for under this item.

Culvert sections shall be manufactured in accordance with the applicable requirements of Section 900 and M4 of the Standard Specifications as amended by the Supplemental Specifications, the Plans and this Special Provision. Where the Plans and Specifications do not provide specific requirements, the manufacturer's recommendations shall be followed.

## Basis of Acceptance

Acceptability of the culvert sections produced shall be determined by the Engineer based upon the results of all required material tests and by inspection of the furnished precast concrete culvert sections.

## Materials

Concrete – Culvert cement concrete shall conform to the requirements of M4.02.00. The minimum cementitious content shall be 705 pounds per cubic yard of cement concrete in accordance with the approved cement concrete mix design. The minimum concrete compressive strength shall be 5000 psi at 28 days.

Aggregates – Aggregates shall conform to requirements of M4.02.02.

Admixtures – Admixtures may be used in accordance with the approved cement concrete mix design.

Steel Reinforcement – All structural reinforcement shall consist of epoxy coated welded wire fabric conforming to M8.01.2 or epoxy coated deformed billet-steel bars conforming to M8.01.0. Any additional reinforcement or embedded devices required for shipping and handling purposes shall be epoxy coated and/or hot dipped galvanized and as shown on the shop drawings submitted for approval of the Engineer.

Non-Shrink Grout – All non-shrink grout shall be 5000 psi with a maximum aggregate size of ¼ inch.

## Design

The Contractor shall submit design calculations and drawings for the culvert prepared in accordance with the Latest AASHTO LRFD Bridge Design Specifications and the MassDOT LRFD Bridge Design Manual using English units for approval of the Engineer. Two (2) independent sets of design computations shall be submitted for approval. To expedite the review and approval process, submissions containing computer computations shall include electronic copies of the actual input and output files. The design computations shall consider all loadings as are appropriate for each stage of fabrication, shipment, construction and upon completion. Design computations and shop drawings shall be prepared by a Professional Engineer licensed to practice in the Commonwealth of Massachusetts.

Prior to fabrication, eight (8) sets of complete shop drawings showing, as a minimum, the following information shall be submitted to the Engineer for approval:

1. Plan layout of the structure indicating the piece mark of each culvert section;
2. Complete details of all precast sections, including all dimensions and tolerances, locations and types of reinforcement, finish treatments, and concrete strengths at lifting and at 28 days;
3. Joint dimensions and details including type and brand of joint sealing materials;
4. Locations and methods of forming lifting holes, type and location of lifting devices, and the method of handling and transporting all precast concrete sections to the job site.

Placement of Reinforcement – The minimum cover of concrete over the reinforcement shall be 2 inches. Reinforcement shall be assembled utilizing any combination of single or multiple layers of welded-wire fabric or deformed billet-steel bars. The welded-wire fabric or deformed billet-steel bars shall meet the spacing requirements shown on the Plans and as approved by the Engineer. All reinforcement tie wires shall be epoxy coated.

### Joints

The precast reinforced concrete culvert shall be produced with joints/keyways per the manufacturer's recommendations and as approved by the Engineer. The frame sections shall be manufactured such that when the sections are laid together they will make a continuous line with a smooth interior surface free of appreciable irregularities, and in compliance with the permissible variations. The joints shall be sealed as shown on the Plans or as recommended by the manufacturer.

As a minimum, the joints between the culvert elements must be sealed by placing sections of 1½" diameter preformed mastic in each joint. The joint is then covered with a 9 inch self-adhering strip of rubberized asphalt flashing meeting the culvert manufacturer's minimum specifications.

Manufacturing – The manufacturing shall be in accordance with M4.02.14 except as amended below.

Concrete Mixture – The aggregates, cement and water shall be proportioned and mixed to produce a homogeneous concrete meeting the strength requirements of this specification and as approved by the Engineer.

### Permissible Variations

Internal Dimensions – The internal dimensions shall not vary more than  $\pm 1"$  in span and  $\pm \frac{1}{2}"$  in rise from the design dimensions.

Wall and top slab thickness – The thickness of the culvert components shall not be less than that shown in the design by more than  $\frac{1}{2}"$ . A thickness more than that required in the design shall not be cause for rejection.

Length of Opposite Surfaces – Variations in laying lengths of two opposite surfaces of the culvert shall not be more than  $\frac{3}{4}"$  in any section.

Length of Section – The length of any section shall not have more or less than  $\frac{1}{2}"$  variance in any culvert section.

Position of Reinforcement – The maximum variation in the position of the reinforcement shall be  $\pm \frac{1}{2}"$  unless otherwise stated and in accordance with ACI 318 Section 7.5. In no case, however, shall the cover over the reinforcement be less than 2", as measured to the internal surface of the external surface of the culvert. The above tolerances or cover requirements do not apply to mating surfaces of the joint.

Area of Reinforcement – The areas of steel reinforcement shall be the design steel areas as approved by the Engineer. Steel areas greater than those required shall not be cause for rejection. The permissible variation in diameter for any reinforcement shall conform to the tolerances prescribed in the ASTM Specification for that type of reinforcement.

### Workmanship and Finish

The culvert sections shall be substantially free of fractures. The ends of the culvert shall conform to the angles and dimensions shown on the Plans.

### Repairs

Culvert sections repaired because of occasional imperfections in manufacture or handling damage will be acceptable if, in the opinion of the Engineer, the repairs are sound, properly finished and cured, and the repaired culvert section conforms to the requirements of this specification.

### Inspection

The quality of materials, the process of manufacture, and the finished culvert sections shall be subject to inspection by the Engineer.

### Rejection

Culvert sections shall be subject to rejection due to the failure to conform to any of the specification requirements. Individual culvert sections may be rejected because of any of the following:

1. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint;
2. Defects that indicate imperfect proportioning, mixing, and molding;
3. Excessive honeycombed or open texture;
4. Damaged ends at time of delivery, where such damage would prevent a satisfactory joint.
5. Construction of culvert unit that is outside of the permissible tolerances.

### Marking

The following information shall be clearly marked on the interior of each culvert section by indentation, waterproof paint, or other approved means:

1. Culvert span and rise;
2. Date of manufacture and lot number;
3. Name and trademark of the manufacturer.

## Installation

The precast concrete culvert system shall be installed in accordance with the lines and grades indicated on the Plans and the requirements described in the Plans and specification. The Contractor shall supply competent workmen and equipment sufficient to install the culvert sections in a safe, accurate and workmanlike manner.

Backfilling operations shall not begin until the following checks have been made:

1. The joints between the sections are complete as shown on the Plans;
2. All joint seals are properly placed.

Backfill shall be paid for under separate items. The backfilling procedures shall be in accordance with Sections 120, 150, and 170 of the Standards with the following modifications:

1. Fill shall be placed and compacted in layers not exceeding 1 foot in depth;
2. Dumping of fill shall not be allowed any nearer to the structure than 3 feet from a vertical plane extending from the back of footing;
3. Backfill shall be placed as symmetrically as possible around the culvert with differential depths of backfill on each side of the culvert not exceeding 18" with respect to each other;
4. Compaction shall be achieved using hand compaction equipment for all fill within 1 foot of the structure;
5. The bare structure shall not be crossed by any equipment heavier than that specified by the culvert manufacturer. All damage resulting from equipment damage shall be rectified to the satisfaction of the Engineer at no cost;
6. Construction equipment will not be permitted atop an uncompleted structure;
7. Construction equipment whose weight exceeds the design capacity shall not be permitted atop the completed structure under any circumstances;
8. The use of vibratory rollers for compaction purposes will not be permitted.

A representative of the manufacturer shall be on site at the commencement of the installation, at no cost to the Department, to assist the Contractor. The representative shall offer advisory assistance only and shall not supplant the Contractor's representative or the Engineer.

## **NATURAL SUBSTRATE BOTTOM**

The natural substrate construction material is to be placed within the culvert and the immediate upstream and downstream area as depicted on the plans. The intent of this item is to replicate within the culvert area an environment that is similar to the existing environment adjacent to the work area.

The Contractor shall excavate to install the new structures. Any material can be stockpiled and reused for the natural substrate bottom, provided the material is characteristic of the existing material upstream and downstream of the work area, or meets the criteria below. The elevations and conditions of the existing ground shall be maintained to the maximum extent practicable.

If the excavated material is not suitable or there is not enough material, the natural substrate material shall be comprised of a natural stone mix – gravel/cobble;  $\leq 6$ " cobbles.

The natural substrate stone shall be native cobbles and gravel similar in shape and size of the stone adjacent to the work area. Large angular stones shall not be used. Crushed Stone will not be accepted.

### **BASIS OF PAYMENT**

Culvert Structure, Culvert No. A-02-xxx(xxx) will be paid for at the Contract lump sum price, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

### **ITEM 996.31      MECHANICALLY STABILIZED EARTH WALL      SQUARE YARD**

#### **DESCRIPTION**

The work under this item shall consist of design, fabrication, furnishing, transportation, and erection of a Mechanically Stabilized Earth (MSE) retaining wall system of the required type, including, backfill and miscellaneous items necessary for a complete installation.

The MSE retaining walls shall consist of reinforcing strips or reinforcing mesh earth wall systems utilizing architectural precast concrete facing panels supported on cast-in-place concrete leveling pads. All reinforcing strips or mesh material shall consist of galvanized steel. The wall structures shall be dimensioned to achieve the design criteria shown on the Plans and specified herein.

The MSE retaining walls shall be constructed in accordance with these specifications and in conformity with the lines, grades, design criteria, and dimensions shown on the Plans or established by the Engineer.

#### **QUALITY ASSURANCE**

Mechanically Stabilized Earth (MSE) retaining walls shall be designed and constructed as specified herein. The design shall be subject to approval by the Engineer. Any additional design, construction or other costs arising as a result of rejection of a retaining wall design by the Engineer shall be borne by the Contractor.

Precast facing panels shall be manufactured in a concrete products plant with MHD approved facilities. Before proceeding with production, precast sample units shall be provided for the Project Engineer's acceptance. These samples shall be kept at the plant to be used for comparison purposes during production. All calculations and Shop Drawings shall be signed and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts and specializing in geotechnical construction.

The contractor installing the MSE retaining walls shall have demonstrated experience constructing MSE walls and shall use personnel having demonstrated experience in the installation procedures recommended by the manufacturers and as specified herein.



Approved MSE retaining wall systems are:

Reinforced Earth ® by the Reinforced Earth Company  
Retained Earth ™ by Foster Geotechnical  
Vist-A-Wall MSE Structural System – by Vist-A-Wall System, LLC  
Tricon Retained Soil Wall System – by Tricon Precast, Ltd.  
Or an approved equal.

Value engineering is not applicable to the work of this item.

The Contractor shall design and build the MSE retaining wall system using only one of the above approved systems. Alternate systems will not be considered.

Requirements for the precast facing panels are different from the standard panels from the approved systems. Appropriate, alternate details shall be prepared by the Contractor.

All MSE walls shall be built in accordance with the Plans and accepted Shop Drawings for the proposed wall systems.

A qualified representative from the wall manufacturer shall be present during construction of the MSE walls as specified in Item 996.33 - MSE Wall Manufacturers Representative.

### **DESIGN REQUIRMENTS**

The MSE retaining walls shall be designed to provide the grade separation shown on the Plans with a service life of not less than 75 years.

In general, the MSE wall system shall be designed in accordance with the manufacturer's requirements, as specified herein and shown on the Plans, and in accordance with AASHTO LRFD Bridge Design Standards including the 2013 Interim, Section 11.10. Where conflicting requirements occur the more stringent shall govern.

The MSE walls shall be dimensioned so that the maximum bearing pressure does not exceed the allowable bearing capacity shown on the plans.

The MSE wall design shall follow the general dimensions of the wall envelope shown on the Plans. Base of footing elevation shall be a minimum of 4 feet below the proposed final grade elevation at the front face of wall for frost protection. All wall elements shall be within the right-of-way limits shown on the Plans. The panels shall be placed so as not to interfere with drainage or other utilities, or other potential obstructions.

Facing panels shall have tongue and groove, ship lap or similar approved connections along all joints, both vertical and horizontal.

MSE facing panels shall be installed on cast-in-place concrete leveling pads.

All appurtenances behind, in front of, under, mounted upon, or passing through the wall such as drainage structures, utilities, fences, concrete parapet wall or other appurtenances shown on the Plans shall be accounted for in the stability design of the wall.

Walls or wall sections which intersect at an angle of one hundred thirty (130) degrees or less shall include a special corner element to cover the joint formed by the abutting walls or wall sections and to permit relative movement. Corner elements shall not consist of connected standard facing panels.

## **MATERIALS**

The Contractor shall be responsible for the purchase or manufacture of the precast concrete facing panels, reinforcing mesh or strips, panel/reinforcement connections, bearing pads, joint filler, and all other necessary components. The Contractor shall furnish to the Engineer the appropriate Certificates of Compliance certifying that the applicable wall materials meet the requirements of the project specifications. All materials used in the construction of the MSE retaining walls shall meet the requirements specified in MassDOT Standard Specifications and as specified herein.

Materials not conforming to this section of the specifications or from sources not listed in the contract documents shall not be used without written consent from the Engineer.

### **Reinforced Concrete Facing Panels**

The panels shall be fabricated in accordance with Section M4 and Section 901, with the following exceptions and additions:

- A. The facing panels shall be manufactured of 5000 psi, 3/4 inch, 705, air-entrained cement concrete as follows:
  1. Reinforced Concrete Facing Panels shall nominally measure 5' high by 10' long on the exterior exposed face without additional tabs or interlocking extensions adding to the overall dimension of the panel face. Panel dimensions and layout shall include a minimum design joint width of 3/4" in order to accommodate differential settlement without impairing the appearance of the facing or compromising the structural integrity of individual panels. Panel joints should be maintained at 3/4" throughout the wall.
  2. Inspection and Rejection: The quality of materials, process of manufacture, and finished units shall be subject to inspection by the Engineer prior to shipment. Precast units may be subject to rejection on account of failure to conform to this specification. Individual units may be rejected because of any of the following:
    - a.) Variations in the exposed face that substantially deviate from the approved architectural model as to color, texture, relief and reveals in accordance with precast concrete industry standards.
    - b.) Dimensions not conforming to the following tolerances:
      - Position of panel connection devices within 1", except for coil and loop imbeds which shall be 3/16". All other dimensions within 3/16".
      - Panel squareness as determined by the difference between the two diagonals shall not exceed 1/2".

- Surface defects on smooth-formed surfaces measured over a length of five feet shall not exceed 1/8". Surface defects on textured-finished surfaces measured over a length of 5' shall not exceed 5/16".
- c.) Defects indicating honeycombed or open texture.
- d.) Defects which would affect the structural integrity of the unit including cracked or severely chipped panels.
- B. The units shall be fully supported until the concrete reaches a minimum compressive strength of 1,500 psi. The units may be shipped after reaching a minimum compressive strength of 4,400 psi. At the option of the Contractor, the units may be installed after the concrete reaches a minimum compressive strength of 4,400 psi.
- C. Unless otherwise indicated on the plans, the concrete surfaces shall be finished in accordance with Section 901.68 and as modified herein. The panels shall be cast on a flat area. The coil embeds, tie strip guide, and other galvanized devices shall not contact or be attached to the face panel reinforcement steel.
- D. The wall finish shall be a rustic ashlar stone finish. Form liners shall be manufactured by one of the following approved form liner manufacturers:
  1. Greenstreak Form Liners, by Greenstreak, St. Louis, Missouri
  2. Symons Form Liner, by Dayton Superior, Miamisburg, Ohio
  3. Custom Rock Form Liners, by Custom Rock, St. Paul, Minnesota
- E. The date of manufacture, production lot number, and the piece mark shall be clearly scribed on an unexposed face of each panel.
- F. All units shall be handled, stored, and shipped in such a manner as to eliminate the dangers of chipping, discoloration, cracks, fractures, and excessive bending stresses. Panels in storage shall be supported in firm blocking to protect the panel connection devices and the exposed exterior finish.
- G. Reinforcing steel for precast panels shall be plain uncoated reinforcing bars in accordance with Section M8.
- H. Quality assurance and testing will be modified by the following:

Compressive Strength - Acceptance of concrete panels with respect to compressive strength will be determined on the basis of production lots. A production lot is defined as a group of panels that will be represented by a single compressive strength sample and will consist of either 40 panels or a single day's production, whichever is less.

During the production of the concrete panels, the manufacturer will randomly sample the concrete in accordance with AASHTO T141 (ASTM C172). A single compressive strength sample, consisting of a minimum of four cylinders, will be randomly selected for every production lot.

Compressive tests shall be made on a standard 6-inch by 12-inch test specimen prepared in accordance with AASHTO T23 (ASTM C31). Compressive strength testing shall be conducted in accordance with AASHTO T22 (ASTM C39).

Air content will be performed in accordance with AASHTO T152 (ASTM C231) or AASHTO T196 (ASTM C173). Air content samples will be taken at the beginning of each day's production and at the same time as compressive samples are taken to insure compliance.

The slump test will be performed in accordance with AASHTO T119 (ASTM C143). The slump will be determined at the beginning of each day's production and at the same time as the compressive samples are taken.

For every compressive strength sample, a minimum of two cylinders shall be cured in accordance with AASHTO T23 (ASTM C31) and tested at 28 days. The average compressive strength of these cylinders, when tested in accordance with AASHTO T22 (ASTM C39) will provide a compressive strength test result which will determine the compressive strength of the production lot.

If the Contractor wishes to ship the panels prior to 28 days, a minimum of two additional cylinders will be cured in the same manner as the panels. The average compressive strength of these cylinders when tested in accordance with AASHTO T22 (ASTM C39) will determine whether panels can be shipped.

Acceptance of a production lot will be made if the compressive strength test result is greater than or equal to 5,000 pounds per square inch. If the compressive strength test result is less than 5,000 pounds per square inch, then the acceptance of the production lot will be based on its meeting the following acceptance criteria in their entirety:

1. Ninety percent of the compressive strength test results for the overall production shall exceed 5,150 pounds per square inch.
2. The average of any six consecutive compressive strength test results shall exceed 5,250 pounds per square inch.
3. No individual compressive strength test result shall fall below 4,600 psi.

#### Soil Reinforcing and Attachment Devices

All reinforcing and attachment devices shall be carefully inspected to insure they are true to size and free from defects that may impair their strength and durability.

- A. Ribbed Reinforcing Strips - Ribbed reinforcing strips shall be hot rolled from bars to the required shape and dimensions. Their physical and mechanical properties shall conform to either AASHTO M183 (ASTM A36) or AASHTO M223 Grade 65 (ASTM A572). Galvanization shall conform to the minimum requirements of AASHTO M111 (ASTM A123).

- B. Reinforcing Mesh-Reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of AASHTO M32 (ASTM A82) and shall be welded into the finished mesh fabric in accordance with AASHTO M55 (ASTM A185). Galvanization shall be applied after the mesh is fabricated and conform to the minimum requirements of AASHTO M111 (ASTM A123).
- C. Tie Strips - The tie strips shall be shop fabricated of hot rolled steel conforming to the minimum requirements of ASTM A570, Grade 50 or equivalent. Galvanization shall conform to AASHTO M111 (ASTM A123).
- D. Coil Embeds/Loop Embeds-Shall be fabricated of cold drawn steel wire conforming to ASTM 510, UNS G 10350 or AASHTO M32 (ASTM A82). Loop imbeds shall be welded in accordance with AASHTO M55 (ASTM A185). Both shall be galvanized in accordance with ASTM B633.
- E. Coil Embed Grease - The cavity of each coil embed shall be completely filled with no-oxide type grease.
- F. Coil Bolt - The coil bolts shall have two inches of thread. They shall be cast of 80-55-06 ductile iron conforming to ASTM A536. Galvanization shall conform to ASTM B633.
- G. Fasteners - Fasteners shall consist of hexagonal cap screw bolts and nuts, which are galvanized and conform to the requirements of AASHTO M164 (ASTM A325) or equivalent.
- H. Connector Pins-Connector pins and mat bars shall be fabricated from AASHTO M183 (ASTM A36) steel and welded to the soil reinforcement mats as shown on the Plans. Galvanization shall conform to AASHTO M111 (ASTM A123).

#### Joint Materials

Installed to the dimensions and thickness in accordance with the Plans or approved shop drawings.

- A. Provide either preformed EPDM rubber pads conforming to ASTM D2000 for 4AA, 812 rubbers or neoprene elastomeric pads having a Durometer Hardness of  $55 \pm 5$ .
- B. Cover all joints between panels on the back side of the wall with a geotextile fabric. The geotextile fabric shall conform to the requirements of Section M9.50.0, Type II. Slit film and multifilament woven and resin bonded non-woven geotextile fabrics are not allowed for this application. The minimum width of the fabric shall be 12 inches. Lap fabric at least 4 inches where splices are required.

#### Backfill Material

Backfill materials used in the MSE Walls volume when installed below maximum groundwater elevation shall conform to Crushed Stone M2.01.5 and when installed above maximum groundwater elevation shall conform to Gravel Borrow M1.03.0(b) and the following additional requirements:

A. Soundness - The material shall be substantially free of shale or other soft, poor durability particles. The materials shall have a magnesium sulfate soundness loss, as determined by AASHTO T104 (ASTM C88), of less than 30 percent after four cycles.

B. Electrochemical Requirements - The backfill materials shall meet the following criteria:

<u>Requirements</u>		<u>Test Methods</u>
Resistivity	>3,000 ohm centimeters	AASHTO T288 (ASTM G57)
pH between	5 and 10, inclusive	AASHTO T289 (ASTM G51)
Chlorides	<100 parts per million	AASHTO T291 (ASTM D512)
Sulfates	<200 parts per million	AASHTO T290 (ASTM D516)
Organic Content	< 1%	AASHTO T267-86

#### Leveling Pad

The leveling pad shall be constructed of 3000 psi, 1-1/2 inch, 470-pound cement concrete as specified in Section M4. Leveling pad shall have minimum dimensions of 8 inches thickness and 12 inches width and be placed at the design elevation shown on the plans within a 1/8 inch tolerance.

#### Acceptance of Material

The Contractor shall furnish to the Engineer a Certificate of Compliance certifying that the above materials comply with the applicable contract specifications. A copy of all test results performed by the Contractor necessary to assure contract compliance shall also be furnished to the Engineer. Acceptance will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Engineer.

### **SUBMITTALS**

A. Design computations demonstrating compliance with the criteria specified herein and shown on the Plans, prepared and signed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts and specializing in geotechnical engineering.

The design calculations shall include:

1. Statement of all assumptions made and copies of all references used in the calculations.
2. Analyses demonstrating compliance with all applicable earth, water, surcharges, seismic, or other loads, as specified herein and required by AASHTO.
3. External stability calculations for the MSE wall, including evaluation of sliding, overturning, bearing resistance, settlement, and short-term and long-term slope stability.
4. Analyses or studies demonstrating durability and corrosion resistance of retaining wall systems for the proposed location and environment. The designers shall provide all corrosion protection devices necessary for the retaining wall to have a minimum service life of 75 years in the proposed location and environment.

B. A detailed resume of the wall designer listing similar projects and demonstrating necessary experience to perform the MSE retaining wall design, including a brief description of each project that is similar in scope. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address and current phone number.

- C. A detailed listing of MSE walls that the contractor has constructed including a brief description of each project and a listing of personnel who will construct the walls demonstrating their experience in construction of MSE retaining walls. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address and current phone number.
- D. Manufacturer's product data for the MSE wall system, including material, manufacture and erection specifications, all specified erection equipment necessary, details of buried MSE wall elements, special details required of reinforcing layout around drainage structures and sign foundations, structures design properties, type of backfill and details for connections between facing panels.
- E. Concrete mix design in accordance with Section M4.
- F. Shop Drawings showing the configuration and all details, dimensions, quantities and cross-sections necessary to construct the MSE wall, including but not limited to the following:
  - 1. A plan view of the wall which shall include Contract limits, stations and offsets, and the face of wall line shown on the Plans
  - 2. An elevation view of the wall which shall include the elevation at the top of the wall at all horizontal and vertical break points and at least every 50 feet along the face of the wall, all steps in the leveling pads, the designation as to the type of retaining wall system(s), and an indication of the final ground line and maximum calculated bearing pressures. The face of wall shown on the Plans shall be indicated.
  - 3. A typical cross section or cross sections showing the elevation relationship between existing ground conditions and proposed grades, and the proposed wall configuration, including details for the proposed methods for connecting to existing conditions. The sections shall also indicate the location of the face of wall shown on the Plans.
  - 4. General notes pertaining to design criteria and wall construction.
  - 5. A listing of the summary of material quantities for each wall.
  - 6. Details of sleeves and pipes and other embedded items to be installed through the walls.
  - 7. Clearly indicated details for construction of walls or reinforcing elements around drainage, foundations, utilities or any other potential obstructions.
  - 8. Details of the architectural treatment of facing panels.
  - 9. Drainage design detail and design scheme.
  - 10. Location of utilities.
  - 11. Sequence and schedule of construction, including overall construction schedule.
  - 12. Method of backfill.
  - 13. Method of maintaining stability of excavated trenches.
  - 14. Method of monitoring plumbness and deviation of wall.
  - 15. Any acceptance testing and frequency.
  - 16. Details and location of all necessary construction and expansion joints.
  - 17. Connection details at the interface of the wall and any adjacent proposed cast-in-place retaining wall or abutment structure.
  - 18. Details of impermeable membrane connection to facing panels and to runoff collection system.

**G. Samples:****1. Precast Reinforced Concrete Facing Panels/Units**

- a. Prior to commencing manufacture of facing panels, the Contractor shall provide samples and mock-ups of the facing panel unit and specified finish. The sample submittal shall consist of a minimum of two 6-inch – 6 inch x 2 inch thick samples indicating the specified finish.
- b. Upon approval of the sample submittal, two mock-up panels 5 feet x 5 feet shall be cast, one of which shall be made available at the casting plant and the other at the Engineer's office to establish acceptance criteria for the approved finished surface. All sample submittals must be accepted by the Engineer for visual qualities prior to proceeding with the casting of the panels.
- c. The MSE wall mock-up units shall be maintained and protected throughout the work of this item to serve as criteria for acceptance of this work. The same custom form liner must be used exclusively for all textured architectural finish surfaces on the job. Using form liners from different manufacturers together on the same job will not be permitted.

**CONSTRUCTION****Delivery, Storage and Handling**

The Contractor shall check the material upon delivery to assure that the proper material has been received. A product certification should be provided with each shipment.

All wall materials and facing panels shall be stored elevated from the ground and protected to prevent all mud, wet cement, epoxy and like substances which may affix themselves to the panels or materials. The panels shall be supported during storage to prevent excessive bending stress. For storage exceeding 30 days in duration, all materials shall be stored in or beneath a trailer or covered with a colored tarpaulin to prevent long-term exposure.

**Wall Excavation**

Muck Excavation to remove unsuitable soils as defined in Section 120 shall be performed as part of the general site preparation prior to wall excavation. Muck Excavation shall be paid for separately under Item 123.

Earth excavations for walls, not including Muck Excavation, shall be in accordance with the requirements of Section 120 and in close conformity to the limits and construction stages shown on the Plans. Sections 120.80, 120.81, and 120.82 do not apply to the work covered in this section. Payment for excavation and incidentals to complete the excavation shall be paid separately under Item 120.

**Foundation Preparation**

The foundation for the structure shall be graded level for a width equal to the length of reinforcement elements plus 1 foot. Prior to wall construction the foundation shall be compacted with at least 10 passes of a smooth wheel vibratory roller weighing at least 10,000 lbs. Any foundation soils found to be unsuitable shall be removed and replaced with Special Borrow Material as per Section 140. In areas below the existing groundwater level, backfill shall consist of Crushed Stone for Bridge Foundations as per Section 150. The foundation for the structure shall be approved by the Engineer before erection is started.



### Wall Erection

Precast concrete panels shall be placed so that their final position is vertical or battered as shown on the Plans. For erection, panels are handled by means of lifting devices connected to the upper edge of the panel. Panels should be placed in successive horizontal lifts in the sequence shown on the approved Shop Drawings as backfill placement proceeds.

As backfill material is placed behind the panels, the panels shall be maintained in position by means of temporary wedges or bracing according to the wall supplier's recommendations. Concrete facing vertical tolerances and horizontal alignment tolerances shall not exceed 3/4 inch when measured with a ten-foot straight edge. During construction, the maximum allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (top to bottom) shall not exceed 1/2 inch per ten feet of wall height.

### Backfill Placement

Backfill placement shall closely follow erection of each course of panels. Backfill shall be placed in such a manner as to avoid any damage or disturbance of the wall materials or misalignment of the facing panels or reinforcing elements. Any wall materials which become damaged during backfill placement shall be removed and replaced at the Contractor's expense. Any misalignment or distortion of the wall facing panels due to placement of backfill outside the limits of this specification shall be corrected at the Contractor's expense. At each reinforcement level, the backfill shall be placed to the level of the connection. Backfill placement methods near the facing shall assure that no voids exist directly beneath the reinforcing elements.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize corrections as outlined in Note 7 of that test). For backfills containing more than 30 percent retained on the 3/4 inch sieve, a method of compaction consisting of at least 4 passes by a heavy roller shall be used.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

The maximum lift thickness after compaction shall not exceed 12 inches. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density. In areas of two-way (overlapping) MSE wall reinforcement, lift thickness shall be limited to the height between the overlapping reinforcement layers. In confined areas, place only 6-inch layers and compact with manually operated, powered vibratory compactor acceptable to the Engineer.

Compaction within 5 feet of walls less than 15-feet high, or within 10 feet of walls greater than 15- feet high should be performed using vibratory walk-behind roller or plate compactor.

At the end of each day's operation, the Contractor shall slope the last lift of the backfill away from the wall facing to rapidly direct runoff away from the wall face. In addition, the Contractor shall not allow surface runoff from other areas to enter the wall construction site.

## **COMPENSATION**

MSE walls will be measured in units of vertical square yard of retaining structure installed complete in place, according to lines, grades, and dimensions shown on the Plans. The vertical area of retaining structure is defined as the area, measured at the wall face, bounded by the top of the leveling pad, ends of wall, and top of coping.

Payment will be at the contract unit price per vertical square yard for design, fabrication, transportation, and erection of MSE retaining walls, including backfill and miscellaneous items necessary for a complete installation, which price and payment will be full compensation for all labor, tools, equipment, materials and incidental expense necessary to complete this item to the satisfaction of the Engineer.

The unit price for Mechanically Stabilized Earth Wall shall include costs for:

- A. All design work, preparation of written submittals and plans, revision of submittals, sample submittals and any other necessary preliminary work prior to and after acceptance of the retaining wall by the Engineer.
- B. All materials, including transportation, for the MSE walls, including facing panels, MSE reinforcing elements, attachment devices, fasteners, bearing blocks and shims, joint materials, copings, concrete masonry, reinforcing steel, compacted select granular backfill, reinforced stone backfill, geotextile fabric, leveling pads and incidentals.
- C. All labor and equipment required to excavate and prepare the wall foundation, form and cast the leveling pad, erect the MSE wall to the lines and grades shown on the Plans, place and connect attachment devices, install the joint materials, install wall drainage, place and compact backfill, and construct any other items necessary to complete the MSE wall.
- D. All temporary shoring.

Excavation and replacement of any unsuitable materials below the MSE wall limits as shown on the Plans, or as directed by the Engineer, will be measured and paid for as defined in Sections 120, 140, and 150.

### **ITEM 996.330 MSE WALL MANUFACTURER'S REPRESENTATIVE**

### **DAY**

One or more qualified civil engineer(s) representing the Manufacturer of the MSE wall shall be on site at the start of construction of each MSE wall to assist and advise the Contractor in methods of construction and to advise the Engineer in methods of ensuring that the walls are constructed in accordance with the Manufacturer's recommendations. The Engineer shall be notified as to which day the representative will be present at the site. Additionally, the representative shall be available on an as-needed basis, as requested by the Engineer at any time during construction of the walls. In no case shall changes in the plans or specifications recommended by the Manufacturer's Representative be made unless submitted in writing and approved by the Engineer.

The Contractor shall submit to the Engineer for approval a daily report of the Wall Manufacturer's Representative activities. The report shall be prepared by the Wall Manufacturer's Representative and shall describe all items investigated, inspected and discussed with MassDOT inspectors and personnel on the job site for that day.

### COMPENSATION

Measurement as to the presence of the MSE Wall Manufacturer's Representative shall be measured per day in which one or more qualified Civil Engineers representing the MSE Wall Manufacturer are present at the site to inspect, investigate and/or advise personnel at the site and submits an approved written daily report to the Engineer. It shall be the sole discretion of the Engineer as to which and how many days the Manufacturer's Representative should be at the site. All fees, travel expenses, and testing incurred by the Manufacturer's Representative are considered part of the unit bid price.

Compensation for the MSE Wall Manufacturer's Representative will be at the Contract unit price per day; per person, when one or more qualified Civil Engineers representing the MSE Wall Manufacturer are present at the site. Payment shall not be made for the visits by MSE Wall Manufacturer's Representatives without prior approval of the visit by the Engineer, when a daily report is not provided, or when their presence is required to oversee repairs to defective work or other corrective action.

<b><u>ITEM 996.4</u></b>	<b><u>PREFABRICATED CONCRETE MODULAR</u></b>	<b><u>SQUARE FOOT</u></b>
	<b><u>GRAVITY WALL</u></b>	

### DESCRIPTION

This work shall consist of the construction of a prefabricated modular reinforced concrete gravity wall in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the plans, or established by the Engineer. Included in the scope of the Prefabricated Concrete Modular Gravity Wall construction are all grading necessary for wall construction, excavation, support of excavation, backfill, construction of leveling pads, segmental unit erection, concrete inserts for utility brackets and miscellaneous items necessary for a complete installation.

The Prefabricated Concrete Modular Gravity Wall design shall follow the general dimensions of the wall envelope shown in the contract plans.

The Contractor shall require the design-supplier to supply an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Engineer. The cost associated with the representative is incidental to this item.

## Quality Assurance

Prefabricated Concrete Modular Gravity Walls shall be designed and constructed as specified herein. The design shall be subject to review and acceptance by the Engineer. The acceptability of a Prefabricated Concrete Modular Gravity Wall design shall be at the sole discretion of the Engineer. Any additional design, construction, or other costs arising as a result of rejection of a retaining wall design by the Engineer shall be borne by the Contractor.

Precast segmental unit blocks shall be manufactured in a concrete products plant with MassDOT approved facilities. All calculations and Shop Drawings shall be signed and stamped by a Professional Engineer specializing in geotechnical construction and is registered in the Commonwealth of Massachusetts.

Approved Prefabricated Concrete Modular Gravity Wall systems are:

T-wall Retaining Wall ® by Concrete Systems, Inc.  
Redi Rock Retaining Wall ™ by Michie Corporation/Capital Concrete Products  
Stone Strong Retaining Wall by MBO Precast

The contractor installing the Prefabricated Concrete Modular Gravity Walls shall have demonstrated experience constructing Prefabricated Concrete Modular Gravity Walls and shall use personnel having demonstrated experience in the installation procedures recommended by the manufacturers and as specified herein.

All Prefabricated Concrete Modular Gravity Walls shall be built in accordance with the Plans and accepted Shop Drawings for the proposed wall systems.

## Design Requirements

Work includes furnishing and installing concrete retaining wall units to the lines and grades designated on the Contract Drawings and as specified herein. Base of footing elevation shall be as shown on the Plans. All wall elements shall be within the right-of-way limits shown on the Plans. The panels shall be placed so as not to interfere with drainage or other utilities, or other potential obstructions.

In general, the prefabricated concrete modular block wall system shall be designed in accordance with the manufacturer's requirements, as specified herein and shown on the Plans, and in accordance with AASHTO LRFD Standard Specification for Highway Bridges, Section 11.11. Where conflicting requirements occur, the more stringent shall govern.

The prefabricated modular reinforced concrete gravity walls shall be dimensioned so that the maximum factored bearing pressure does not exceed 6,500 pounds per square foot.

Facing panels shall have tongue and groove, ship lap or similar approved connections along all joints, both vertical and horizontal.

Prefabricated Concrete Modular blocks shall be installed on cast-in-place concrete leveling pads.

All appurtenances behind, in front of, under, mounted upon, or passing through the wall such as drainage structures, utilities, fences, concrete parapet wall or other appurtenances shown on the Plans shall be accounted for in the stability design of the wall. The concrete anchors required for the utility brackets are incidental to this item.

Walls or wall sections which intersect at an angle of one hundred thirty (130) degrees or less shall include a special corner element to cover the joint formed by the abutting walls or wall sections and to permit relative movement. Corner elements shall not consist of connected standard facing panels.

## MATERIALS

The Contractor shall be responsible for the purchase or manufacture of the precast concrete modular blocks, geotextile filters, panel/reinforcement connections, bearing pads, joint filler, and all other necessary components. The Contractor shall furnish to the Engineer the appropriate Certificates of Compliance certifying that the applicable wall materials meet the requirements of the project specifications. All materials used in the construction of the Precast Concrete Modular Block walls shall meet the requirements specified in the following subsections of Division III, Materials Specifications of the MHD Standard Specifications and as specified herein.

Materials not conforming to this section of the specifications or from sources not listed in the contract documents shall not be used without written consent from the Engineer.

### Prefabricated Concrete Modular Block Units

The panels shall be fabricated in accordance with Section M4 and Section 901, with the following exceptions and additions:

- A. Inspection and Rejection: The quality of materials, process of manufacture, and finished units shall be subject to inspection by the Engineer prior to shipment. Precast units may be subject to rejection on account of failure to conform to this specification. Individual units may be rejected because of any of the following:
  - 1. Variations in the exposed face that substantially deviate from the approved architectural model as to color, texture, relief, and reveals in accordance with precast concrete industry standards.
  - 2. Dimensions not conforming to the following tolerances:
    - i. Position of panel connection devices within 1", except for coil and loop imbeds which shall be 3/16". All other dimensions within 3/16".
    - ii. Panel squareness as determined by the difference between the two diagonals shall not exceed 1/2".
    - iii. Surface defects on smooth-formed surfaces measured over a length of five feet shall not exceed 1/8". Surface defects on textured-finished surfaces measured over a length of 5' shall not exceed 5/16".
  - 3. Defects indicating honeycombed or open texture.
  - 4. Defects which would affect the structural integrity of the unit including cracked or severely chipped panels.

- B. Unless otherwise indicated on the plans, the concrete surfaces shall be finished in accordance with Section 901.68 and as modified herein. The panels shall be cast on a flat area. The coil embeds, tie strip guide, and other galvanized devices shall not contact or be attached to the face panel reinforcement steel.
- C. The date of manufacture, production lot number, and the piece mark shall be clearly scribed on an unexposed face of each panel.
- D. All units shall be handled, stored, and shipped in such a manner as to eliminate the dangers of chipping, discoloration, cracks, fractures, and excessive bending stresses. Panels in storage shall be supported in firm blocking to protect the panel connection devices and the exposed exterior finish.
- E. Reinforcing steel for precast panels shall be plain uncoated reinforcing bars in accordance with Section M8.
- F. Quality assurance and testing will be modified by the following:
  - 1. Compressive Strength - Acceptance of concrete panels with respect to compressive strength will be determined on the basis of production lots. A production lot is defined as a group of panels that will be represented by a single compressive strength sample and will consist of either 40 panels or a single day's production, whichever is less.
  - 2. During the production of the concrete panels, the manufacturer will randomly sample the concrete in accordance with AASHTO T141 (ASTM C172). A single compressive strength sample, consisting of a minimum of four cylinders, will be randomly selected for every production lot.
  - 3. Compressive tests shall be made on a standard 6-inch by 12-inch test specimen prepared in accordance with AASHTO T23 (ASTM C31). Compressive strength testing shall be conducted in accordance with AASHTO T22 (ASTM C39).
  - 4. Air content test will be performed in accordance with AASHTO T152 (ASTM C231) or AASHTO T196 (ASTM C173). Air content samples will be taken at the beginning of each day's production and at the same time as compressive samples are taken to insure compliance.
  - 5. The slump test will be performed in accordance with AASHTO T119 (ASTM C143). The slump will be determined at the beginning of each day's production and at the same time as the compressive samples are taken.
  - 6. For every compressive strength sample, a minimum of two cylinders shall be cured in accordance with AASHTO T23 (ASTM C31) and tested at 28 days. The average compressive strength of these cylinders, when tested in accordance with AASHTO T22 (ASTM C39) will provide a compressive strength test result which will determine the compressive strength of the production lot.
  - 7. If the Contractor wishes to ship the panels prior to 28 days, a minimum of two additional cylinders will be cured in the same manner as the modular block units. The average compressive strength of these cylinders when tested in accordance with AASHTO T22 (ASTM C39) will determine whether panels can be shipped.

8. Acceptance of a production lot will be made if the compressive strength test result is greater than or equal to 5,000 pounds per square inch. If the compressive strength test result is less than 5,000 pounds per square inch, then the acceptance of the production lot will be based on its meeting the following acceptance criteria in their entirety:
  - a. Ninety percent of the compressive strength test results for the overall production shall exceed 5,150 pounds per square inch.
  - b. The average of any six consecutive compressive strength test results shall exceed 5,250 pounds per square inch.
  - c. No individual compressive strength test result shall fall below 4,600 psi.

### Joint Materials

Cover all joints between panels on the back side of the wall with a geotextile fabric. The geotextile fabric shall conform to the requirements of Section M9.50.0, Type II. Slit film and multifilament woven and resin bonded non-woven geotextile fabrics are not allowed for this application. The minimum width of the fabric shall be 12 inches. Lap fabric at least 4 inches where splices are required.

### Backfill Material

All backfill materials used in the concrete modular block wall volume shall conform to Gravel Borrow M1.03.0, Type B, and the following additional requirements:

- A. Soundness - The material shall be substantially free of shale or other soft, poor durability particles. The materials shall have a magnesium sulfate soundness loss, as determined by AASHTO T104 (ASTM C88), of less than 30 percent after four cycles.

### Leveling Pad

The leveling pad shall be constructed of 2500 psi, 1-1/2 inch, 425-pound cement concrete as specified in Section M4. Leveling pad shall have minimum dimensions of 8 inches thickness and 12 inches width and be placed at the design elevation shown on the plans within a 1/8 inch tolerance.

### Acceptance of Material

The Contractor shall furnish to the Engineer a Certificate of Compliance certifying that the above materials comply with the applicable contract specifications. A copy of all test results performed by the

Contractor necessary to assure contract compliance shall also be furnished to the Engineer. Acceptance will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Engineer.

## SUBMITTALS

- A. Design computations demonstrating compliance with the criteria specified herein and shown on the Plans, prepared and signed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts and specializing in geotechnical engineering. The design calculations shall include:
1. Statement of all assumptions made and copies of all references used in the calculations.
  2. Analyses demonstrating compliance with all applicable earth, water, surcharges, seismic, or other loads, as specified herein and required by AASHTO.
  3. Analyses or studies demonstrating durability and corrosion resistance of retaining wall systems for the proposed location and environment. The designers shall provide all corrosion protection devices necessary for the retaining wall to have a minimum service life of 75 years in the proposed location and environment.
- B. A detailed resume of the wall designer listing similar projects and demonstrating necessary experience to perform the retaining wall design, including a brief description of each project that is similar in scope. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address and current phone number.
- C. A detailed listing of prefabricated modular block walls that the contractor has constructed, including a brief description of each project and a listing of personnel who will construct the walls, demonstrating their experience in construction of prefabricated modular block walls. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address, and current phone number.
- D. Manufacturer's product data for the prefabricated modular block wall system, including material, manufacture, erection specifications, all specified erection equipment necessary, details of buried prefabricated modular block wall elements, structures design properties, type of backfill, and details for connections between facing panels.
- E. Shop Drawings showing the configuration and all details, dimensions, quantities, and cross-sections necessary to construct the prefabricated modular block wall, including but not limited to the following:
1. A plan view of the wall which shall include Contract limits, stations and offsets, and the face of wall line shown on the Plans.
  2. An elevation view of the wall which shall include the elevations at the top of the wall, at all horizontal and vertical break points, and all steps in the leveling pads. The elevation view shall also show designation as to the type of retaining wall system(s), and an indication of the final ground line and maximum calculated bearing pressures.
  3. A typical cross section or cross sections showing the elevation relationship between existing ground conditions and proposed grades, and the proposed wall configuration, including details for the proposed methods for connecting to proposed conditions. The sections shall also indicate the location of the face of wall shown on the Plans.
  4. General notes pertaining to design criteria and wall construction.



5. A listing of the summary of material quantities for each wall.
6. Details of sleeves and pipes and other embedded items to be installed through the walls.
7. Clearly indicated details for construction of walls around foundations or any other potential obstructions.
8. Details of the architectural treatment of facing panels.
9. Drainage design detail and design scheme.
10. Location of utilities.
11. Sequence and schedule of construction, including overall construction schedule.
12. Methods of excavation and requirements for proper backfill.
13. Method of maintaining stability of excavated trenches.
14. Method of monitoring plumbness and deviation of wall.
15. Excavation support system, if any.
16. Any acceptance testing and frequency.
17. Details and location of all necessary construction and expansion joints.
18. Connection details at the interface of the wall and any adjacent proposed abutment structure.
19. Details of impermeable membrane connection to facing panels and to runoff collection system.

## CONSTRUCTION

### Delivery, Storage, and Handling

The Contractor shall check the material upon delivery to assure that the proper material has been received. A product certification should be provided with each shipment.

All wall materials and modular block units shall be stored elevated from the ground and protected to prevent all mud, wet cement, epoxy, and like substances from affixing themselves to the panels or materials. The panels shall be supported during storage to prevent excessive bending stress. For storage exceeding 30 days in duration, all materials shall be stored in or beneath a trailer or covered with a colored tarpaulin to prevent long-term exposure.

### Wall Excavation

Earth excavations shall be in accordance with the requirements of Section 120 and in close conformity to the limits and construction stages shown on the Plans. Sections 120.80, 120.81, and 120.82 do not apply to the work covered in this section. Payment for excavation and incidentals to complete the excavation are included in the Prefabricated Concrete Modular Block wall Item.

### Foundation Preparation

The foundation for the structure shall be graded level for a width equal to the length of reinforcement elements plus 1 foot. Prior to wall construction the foundation shall be compacted with at least 10 passes of a smooth wheel vibratory roller weighing at least 10,000 lbs. Compact the foundation area to provide a hard and level surface to support the wall units. Any foundation soils found to be unsuitable shall be removed and replaced with Special Borrow Material as per Section 140 and Section 150. The foundation for the structure shall be inspected and approved by the Engineer before erection is started.

### Wall Erection

Precast concrete modular block units shall be placed so that their final position is vertical as shown on the Plans. For erection, panels are handled by means of lifting devices connected to the upper edge of the panel. Panels should be placed in successive horizontal lifts in the sequence shown on the approved Shop Drawings as backfill placement proceeds. As backfill material is placed behind the panels, the panels shall be maintained in position by means of temporary wedges or bracing according to the wall supplier's recommendations. Concrete facing vertical tolerances and horizontal alignment tolerances shall not exceed 3/4 inch when measured with a ten-foot straight edge. During construction, the maximum allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (top to bottom) shall not exceed 1/2 inch per ten feet of wall height.

### Backfill Placement

Backfill placement shall closely follow erection of each course of panels. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the facing panels. Any wall materials which become damaged during backfill placement shall be removed and replaced at the Contractor's expense. Any misalignment or distortion of the wall facing panels due to placement of backfill outside the limits of this specification shall be corrected at the Contractor's expense.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize corrections as outlined in Note 7 of that test). For backfills containing more than 30 percent retained on the 3/4 inch sieve, a method of compaction consisting of at least 4 passes by a heavy roller shall be used.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

The maximum lift thickness after compaction shall not exceed 12 inches. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

Compaction within three feet of the back face of the wall shall be achieved by at least three passes of lightweight mechanical tamper, roller, or vibratory system.

At the end of each day's operation, the Contractor shall slope the last lift of the backfill away from the wall facing to rapidly direct runoff away from the wall face. In addition, the Contractor shall not allow surface runoff from other areas to enter the wall construction site.

### Drainage

Weep holes shall be provided through the face panels along the wall system and can be shop fabricated or field cored.

### COMPENSATION

Prefabricated concrete modular block walls will be measured for payment by the vertical square feet of retaining structure, according to the dimensions shown on the Plans, complete in place. The vertical area of retaining structure is defined as the area, measured at the wall face, bounded by the top of the leveling pad, ends of wall, and top of coping.

Prefabricated concrete modular block walls Payment will be paid for at the Contract unit price per square foot, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for excavation and backfill, but all costs in connection therewith shall be included in the Contract unit price bid.

The unit price for Prefabricated Concrete Modular Block Wall shall include costs for:

- A. All design work, preparation of written submittals and plans, revision of submittals, sample submittals, and any other necessary preliminary work prior to and after acceptance of the retaining wall by the Engineer.
- B. All materials, including transportation for the prefabricated concrete modular block walls, attachment devices, fasteners, bearing blocks and shims, joint materials, copings, concrete masonry, reinforcing steel, and incidentals.
- C. All labor and equipment required to excavate and prepare the wall foundation, form and cast the leveling pad, erect the prefabricated concrete modular block wall to the lines and grades shown on the Plans, place and connect attachment devices, install the joint materials, install wall drainage, place and compact backfill, and construct any other items necessary to complete the prefabricated concrete modular block wall.
- D. All temporary shoring.

## **IMPACTING SITES LIST**

Project 604532 – Acton – Carlisle – Westford – Bruce Freeman Rail Trail Extension, Including 6 Railroad Bridges (Phase II-A)

**Summary of Potentially Impacting Oil and Hazardous Material Release Sites**

**RTN 2-10612, RTN 2-10645, and RTN 2-10942, 930 Main Street, Deck House Inc, Acton:**

This site is located adjacent to the proposed project area and extends from Station 58+50 to Station 66+00. The site is bound to the northwest by the railroad tracks to be redeveloped and to the southeast by Main Street, a self-storage facility, and a multi-tenant commercial building.

On January 1, 1995, MassDEP was notified of a release of oil from a UST at the 930 Main Street property in Acton. MassDEP assigned RTN 2-10612 to the release. On February 2, 1995, MassDEP was notified that contamination from the UST release was identified in groundwater within 500 feet of an on-site drinking water well. MassDEP assigned RTN 2-10645 to the condition

On October 2, 1995, MassDEP was notified of the presence of a layer of separate phase wood preservative (i.e. mineral spirits) on the groundwater table at the property. MassDEP assigned RTN 2-10942 to the release

On June 16, 2003, IES, Inc. of Medford, Massachusetts submitted a Class A-2 RAO for the initial release of oil from the UST (RTN 2-10612). Since the RAO did not address the related groundwater condition (RTN 2-10645), MassDEP retracted the RAO and the site is currently listed as being in Phase V Remedy Operation Status (ROS). RTN 2-10942 has been closed by MassDEP.

It appears that contamination from this release has likely migrated onto the Rail Trail. The contaminants presently found in groundwater on the site are petroleum constituents and pentachlorophenol, all of which occurred at levels above the applicable GW-1 cleanup level as of the last recorded sampling event in 2008. Groundwater is present at the site at depths ranging from 3.17 feet to 6.38 feet. Excavation to a depth of 4 feet for the installation of a fence will take place in this section of the project.

**RTN 2-18897, Rte 27 – Near 960 Main Street, Signal Y, Acton:** A Phase I Environmental Site Assessment was performed for the portions of the Bruce Freeman Rail Trail that are planned for Westford, Carlisle, Acton, and Concord. The site assessment report has been uploaded to ProjectInfo and should be provided to contractors with the bid documents.

As a result of the Phase I ESA, sampling was performed near a selection of signals and battery wells. Levels of cadmium in excess of the applicable Method 1 standards were discovered in the top six inches of soil in the immediate vicinity of Signal Y. Further sampling in the area showed lower levels of contamination and allowed for the submission of a Class B-1 RAO to MassDEP on June 4, 2013.

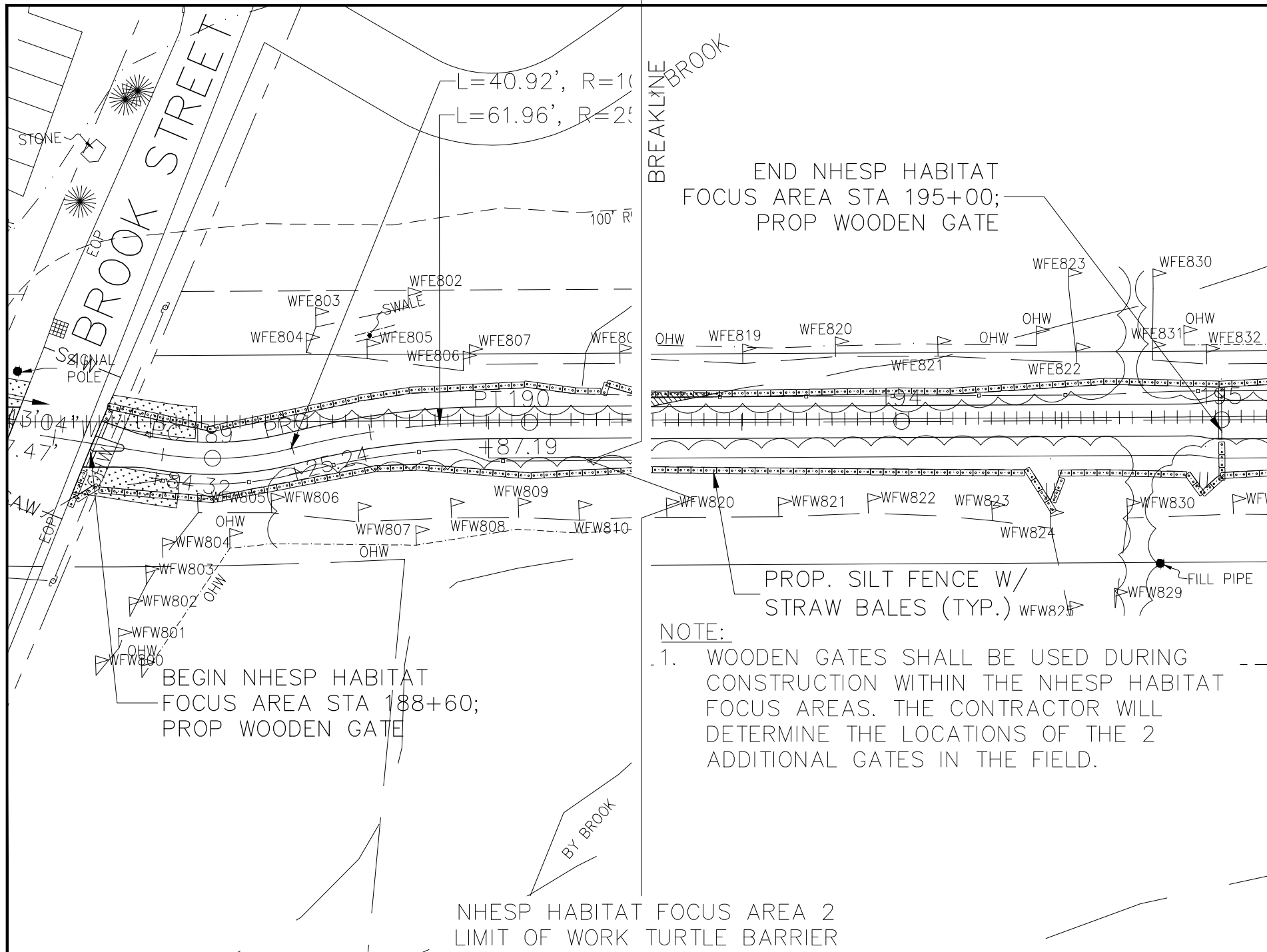
**Battery Well J, Acton:** A Limited Removal Action (LRA) was performed by MassDOT after elevated levels of mercury and zinc were detected in the vicinity of the battery well labeled as Battery Well J in the Phase I report. Due to the success of the LRA, it was unnecessary to report this site to MassDEP.

According to the project manager, battery wells and signals will be removed as part of the project. Soil from these areas has a high probability of contamination and should be handled accordingly. The sampling and LRA reports and the RAO have been uploaded to ProjectInfo and should be provided to contractors with the bid documents.

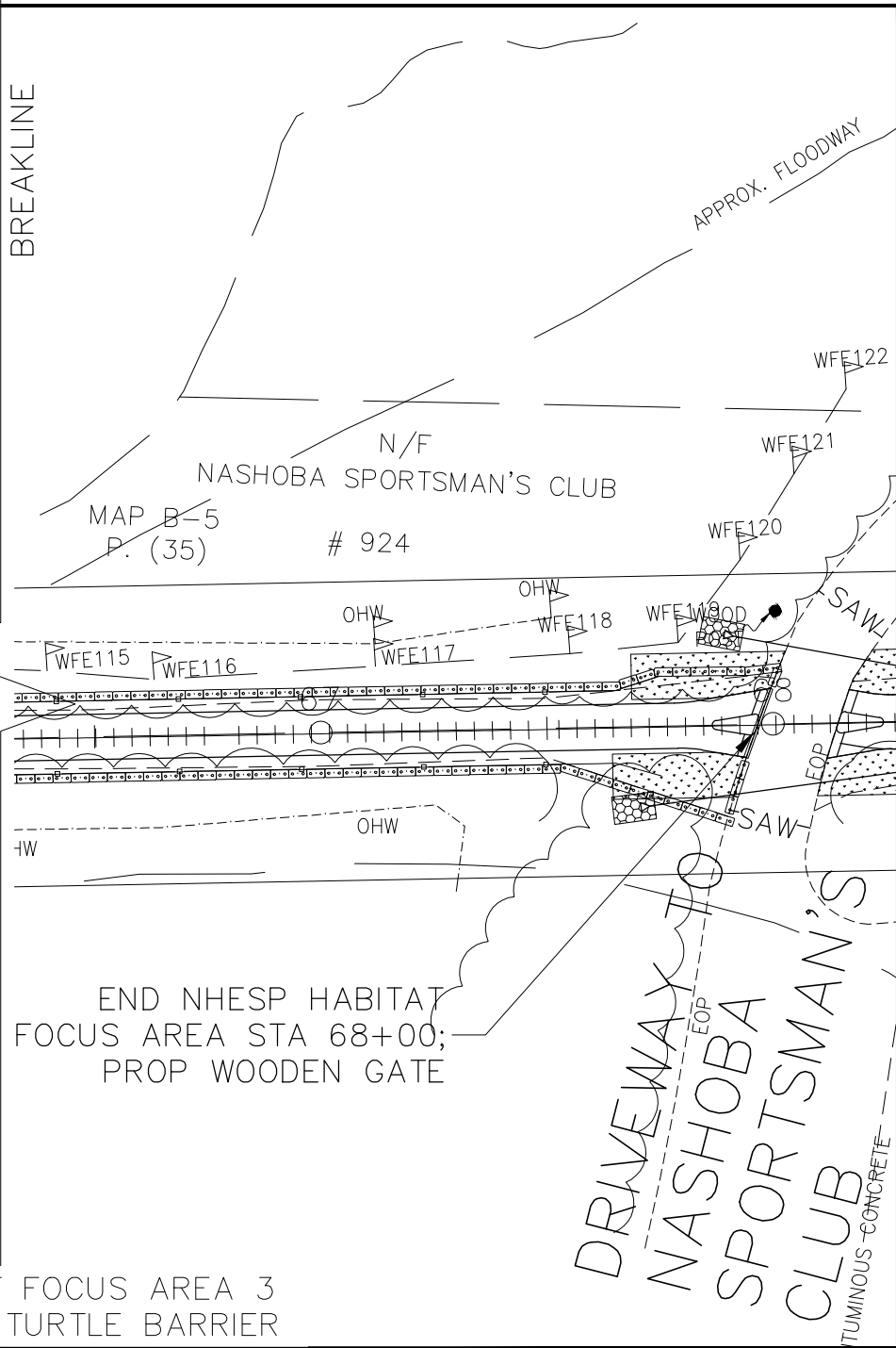
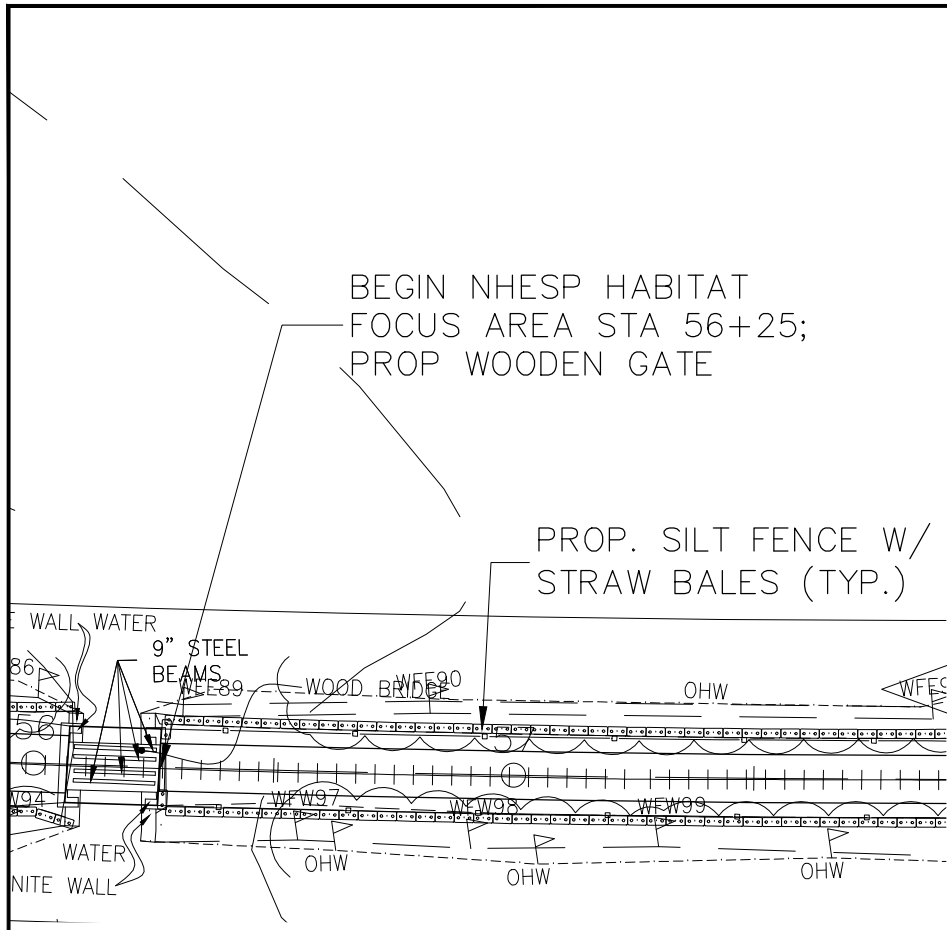
**NHESP HABITAT FOCUS AREA**  
**LIMIT OF WORK TURTLE BARRIER**











**NOTE:**

1. WOODEN GATES SHALL BE USED DURING CONSTRUCTION WITHIN THE NHESP HABITAT FOCUS AREAS. THE CONTRACTOR WILL DETERMINE THE LOCATIONS OF THE 2 ADDITIONAL GATES IN THE FIELD.

MAP B-5  
P. 41  
N/F  
MASSACHUSETTS DEPARTMENT OF  
TRANSPORTATION  
BK. 1219 PG. 271

NHESP HABITAT FOCUS AREA 3  
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