SPECIAL PROVISIONS

UXBRIDGE – RIVER ROAD OVER IRONSTONE BROOK

Federal Aid Project No. BR-002S(146)X

Proposed Bridge Replacement
River Road over Ironstone Brook
Bridge No. U-02-030

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 to be done under this Contract consists of furnishing all labor, materials and equipment required for the replacement of the River Road over Ironstone Brook (Bridge No. U-02-030) bridge superstructure with a folded plate system design supporting a concrete deck and concrete overlay. New abutments will be constructed behind the current ones. The bridge will be widened to provide for two 12'-0" wide lanes, two 4'-0" shoulders, and a 1'-7½" safety curb mounted with a S3-TL4 bridge railing. Sidewalks will not be provided. The roadway centerline will be shifted to the north while the south edge of the roadway is maintained.

The existing bridge was built in 1900 and reconstructed in 1930 and consists of a two-span continuous reinforced concrete slab superstructure, approximately 18-inches deep, supported on a reinforced concrete pier and stone masonry gravity abutments with reinforced concrete caps. The bridge is a total of 31.4 feet in length (from expansion joint to expansion joint). The existing bridge curb-to-curb roadway width is 25'-2" feet consisting of a two-lane roadway 22'-6" wide with 1'-4" shoulders and Type SS guardrail on both sides; the total out-to-out width is 26.4 feet. The existing bridge carries two-way traffic (one lane in each direction). There is a railing consisting of steel pipe posts and a guard rail w-section rub-rail and a wooden top rail mounted along the edge of the deck. There is no sidewalk on the bridge or its approaches. The profile is generally flat. The bridge is posted for 9, 13, 20 Tons.

The roadway design consists of a realignment of the roadway centerline; increasing the existing vertical alignment at the bridge to provide additional clearance between the 10-year flood elevation and the bottom chord; roadway widening; cold planning; paving; construction of mechanically stabilized earth walls; guardrail installation; curbing; drainage; grading and wetland restoration/remediation; utility service connections for bridge instrumentation; signing and striping.

Traffic management and safety controls during construction are also included. The proposed traffic management plan calls for a detour. River Road will be closed to thru traffic during construction at the intersections of Balm of Life Spring Road to the west and Ironstone Street to the east. Traffic will be detoured along Central Street to Quaker Highway (Route 146A), a distance of approximately 4 miles.

All work done under this contract shall be in conformance with the Massachusetts Highway Department *Standard Specifications for Highways and Bridges* dated 1988 and the *English Supplemental Specifications* dated February 25, 2010; the *Standard Special Provisions* contained in this book, the *1977 Construction Standards* and the *Supplemental Drawings* dated April 2003; the *2009 Manual on Uniform Traffic Control Devices* with *Massachusetts Amendments*; the *1990 Standard Drawings for Signs and Supports*; 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.

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

Plans of the existing bridge structure are available for viewing at the office of the Bridge Engineer, Massachusetts Department of Transportation, Highway Division, 10 Park Plaza, Boston, Massachusetts 02116.

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.

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.

BID BONDS

All bid bonds submitted to the Cashier's Office should read (in part) "… are held and firmly bound unto The Massachusetts Department of Transportation."

ENGINEERING DIRECTIVES

Contractors can access MassDOT, Highway Division Engineering Directives at:
http://www.mhd.state.ma.us/default.asp?pgid=content/engineering02&sid=about

CONTRACTOR QUESTIONS

Contractors 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 will not be considered for review by the Department.

EMAIL ADDRESS FOR QUESTIONS AND ADDENDUM ACKNOWLEDGEMENTS

Contractors should email questions and addendum acknowledgements to the following email address mhd-specifications@mhd.state.ma.us . In the email title it is requested that the MassDOT project file number and municipality be included for identification purposes.

All interested parties shall provide their most current email addresses to MassDOT so that they may receive addenda. Interested parties shall provide any revised or additional email addresses to: mhd-specifications@mhd.state.ma.us.

PERSONAL PROTECTIVE SAFETY EQUIPMENT FOR CONTRACTOR PERSONNEL

The Contractor is responsible to ensure that all personnel, including all subcontractors, working on the project are issued and are wearing all necessary personal protective safety equipment while working within the project limits. This equipment shall include, as a minimum, a hardhat and a safety vest, regardless of the type of work being performed. Other safety equipment shall be added as required to perform the work in which they are engaged and in accordance with all local, state and federal requirements in effect. Safety equipment shall be provided at no additional cost to the Department.

APPROVED EQUIVALENT (Supplementing Subsection 5.03 and Section 6.00)

For any materials named or described in these specifications, an approved equivalent to that named or described in the said specifications may be furnished.

ASPHALT BINDER

In order to allow an efficient transition from viscosity graded Asphalt Cement (AC) specifications to performance graded Superpave Binder (PG) specifications (non-modified binder), the Massachusetts Department of Transportation is replacing AC graded products with PG binder as follows:

Projects requiring AC-20 will be constructed using PG 64-28
Projects requiring AC-5 will be constructed using PG 52-34

The Contractor shall follow existing mix design requirements and produce the hot-mix using the required grade of PG binder.

The binder supplier shall provide the Department with PG test results and a certification of the PG binder grade when PG binder is substituted for AC grade asphalt. This testing and certification shall be based on the existing lot numbering system.
The binder supplier shall not mix AC and PG binders in the same tank, unless tested and re-certified to meet the specified grade.

Performance-Graded asphalt shall not have a higher temperature grade than specified without prior approval.

BIDDERS LIST

Pursuant to the provisions of 49 CFR 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.

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).

SUBSECTION 4.06 INCREASED OR DECREASED CONTRACT QUANTITIES

Replace this Subsection with the following: (Revised – 3/05/ 2010)

The quantities contained in the Contract are set forth as a basis for the comparison of bids only and may not necessarily reflect the actual quantity of work to be performed. The Department reserves the right to increase, decrease or eliminate the quantity of any particular item of work.

Where the actual quantity of a pay item varies more than 25 percent above or below the estimated quantity stated in the Contract, an equitable adjustment in the Contract Price for that pay item shall be negotiated upon demand of either party regardless of the cause of the variation in quantity. No allowances will be made for loss of anticipated overhead costs or profits suffered or claimed by the Contractor resulting directly or indirectly from such increased, decreased or eliminated quantities or from unbalanced allocation among the contract items from any other cause. It is the intention of this provision to preserve the bid basis while limiting the Contractor's risk exposure to 25% of each bid quantity.

In the case of an overrun, the contractor will be compensated at the Contract Unit Price for a quantity up to 125% of the Contract quantity. The adjusted unit price shall only be applied to that quantity above 125% of the contract quantity.

Neither party shall be required to demonstrate any change in the cost to perform the work based solely on the overrun. The original Contract unit bid price shall have no bearing on determining the adjusted unit price for an overrun. The adjusted unit price shall be based on the estimated cost of performing the added work over 125% of the bid quantity. In the event that an adjusted unit price cannot be agreed upon within 30 days after being requested by either party, a unit price will be established that is deemed to be fair and equitable by the Engineer, whether higher or lower than the unit price bid. Payment will be made at that rate until agreement is reached or until the Contractor chooses to exercise his rights under Section 7.16.

To assist the Engineer in the determination of an equitable adjustment for an overrun, the Contractor shall prepare a submission in the following manner and accept as full payment for work or materials an amount for an equitable adjustment in the Contract Price equal to the following:

(1) The actual cost or a reasonable cost estimate for direct labor, material (less value of salvage, if any) and use of equipment, plus 10 percent of this total for overhead;
(2) Plus actual cost or a reasonable cost estimate of Worker's Compensation and Liability Insurance, Health, Welfare and Pension Benefits, Social Security deductions and Employment Security Benefits;
(3) Plus 10 percent of the total of (1) and (2) for profit and other unallocated costs;
(4) Plus the estimated proportionate cost of surety bonds.

No allowance shall be made for general superintendence and the use of small tools and manual equipment.

For work performed by a Subcontractor, the Contractor shall accept as full payment therefore an amount equal to the actual cost or the reasonable cost estimate to the Contractor of such work as determined by the Engineer, plus 10 percent of such cost. The Subcontractor is bound by the same criteria for the determination of an equitable adjustment as the Contractor.

In the case of an underrun, the unit price for the actual quantity installed, if less than 75% of the bid quantity, shall only be adjusted to account for increased unit costs that result solely from the decreased quantity. The adjusted unit price shall be the bid price plus the change in the actual unit cost of performing the work due solely to the decreased quantity.

The Contractor shall prepare a submission demonstrating actual increased unit costs for review and evaluation by the Engineer. No allowance will be made for loss of anticipated overhead costs or profits suffered or claimed by the Contractor resulting directly or indirectly from such decreased or eliminated quantities.

The Contractor is required to furnish itemized statements of cost and give the Department access to supporting records.

CONTRACTOR/SUBCONTRACTOR CERTIFICATION – CONTRACT COMPLIANCE
(Revision 01-15-10)

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.

PROMPT PAYMENT AND RELEASE OF RETAINAGE TO SUBCONTRACTORS

The Contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of subcontract work not later than 10 business days from the receipt of each payment the prime contractor receives from the Department. Failure to comply with this requirement may result in the withholding of payment to the prime contractor until such time as all payment due under this provision has 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 not later than 10 business days after the subcontractor has completed all of the work required under its subcontract.

ENVIRONMENTAL PERMITTING

DEP-WATER QUALITY CERTIFICATE

This project is subject to Section 401 of the federal Clean Water Act, 33 USC 1341, and Massachusetts Clean Water Act, M.G.L. c 21, § 26-53, and has been issued a Section 401 Water Quality Certificate ("WQC") by the Department of Environmental Protection. The WQC is considered to be part of this contract and a copy of the WQC and all plans/attachments shall be on-site while activities regulated by the WQC are being performed.

The Contractor's attention is directed to the fact that special conditions and other requirements are associated with the WQC. It is the Contractor's responsibility to be aware of and comply with these conditions and requirements and plan his/her work and schedule accordingly. The Contractor is hereby notified that he/she will be responsible and held accountable for performing any/all work necessary to satisfy and comply with the entire WQC.

The WQC is contained herein. The Contractor is advised that no additional compensation will be allowed for work required to establish, achieve, and maintain compliance with the WQC, as payment for the work shall be included in the various bid items. This work may include, but not limited to, the following: the hiring and paying for services of a Professional Biologist, Botanist, Wetland Scientist, Engineer, Landscape Architect, etc; preparation and submission of as-built plans; wetland flagging; wetland replication monitoring reports, etc.

ARMY CORPS OF ENGINEERS PERMIT

This project is subject to Section 404 of the Federal Clean Water Act, 33 U.S.C. 1251 *et seq* and has been issued a Category II Massachusetts General Permit ("Permit") by the Army Corps of Engineers. The Permit and Application are to be considered part of this contract and a copy of the Permit and all plans/attachments shall be on-site while activities regulated by the Permit are being performed. The Contractor is responsible to be aware of and comply with the restrictions and requirements in said Permit and plan his/her work and schedule accordingly.

The Contractor's attention is directed to the fact that special conditions and other requirements are associated with the Permit. It is the Contractor's responsibility to be aware of and comply with these conditions and requirements and plan his/her work and schedule accordingly. The Contractor is hereby notified that he/she will be responsible and held accountable for performing any/all work necessary to satisfy and comply with the entire Permit.

The Permit is contained herein. The Contractor is advised that no additional compensation will be allowed for work required to establish, achieve, and maintain compliance with the Permit, as payment for the work shall be included in the various bid items. This work may include, but not limited to, the following: the hiring and paying for services of a Professional Biologist, Botanist, Wetland Scientist, Engineer, Landscape Architect, etc; preparation and submission of as-built plans; wetland flagging; wetland replication monitoring reports, etc.

ENVIRONMENTAL PERMITTING

Arrangements for additional copies of the Department of Environmental Protection WQC and/or Army Corps of Engineers Permit can be made by calling the District #3 Environmental Section at (508) 929-3800. If the Contractor wishes to obtain copies, s/he shall do so at his own expense.

If field conditions and/or Contractor-proposed erection, demolition, storage, or other procedures not originally allowed by existing environmental permits require work to occur in or otherwise impact water or wetland resource areas, the Contractor is advised that no associated work can occur until all required environmental permits have been either amended or obtained allowing such work. The Contractor must notify the District #3 Highway Director and Resident Engineer

in writing at least 60 days prior to desire commencement of the proposed activity. All environmental submittals, including any contract with Local, State, or Federal environmental agencies, must be coordinated with the District #3 Environmental Engineer. The Contractor is expected to fully cooperate with requests for information and provide same in a timely manner. The Contractor is further advised that the Department will not entertain a delay claim due to the time required to modify or obtain the environmental permits.

SCHEDULE OF OPERATIONS

(Supplementing Subsection 8.02)

Delete the first paragraph and replace with the following:

The Contractor shall submit, to and for the review and approval of the Engineer, a schedule of operations within ten days after mailing of the executed Contract to the Contractor. The schedule submitted shall include the consideration of staged construction of the following factors: temporary control of groundwater; control of water/dewatering operations; temporary sediment controls; drainage systems construction; bridge demolitions; substructure construction; superstructure construction; retaining wall construction; bridge and highway excavation; roadway work; utility work; project plantings in accordance with contract specifications; sign installations; paving operations and project completion.

WORK SCHEDULE

Work on this project may be performed on a twelve hour day, six day per week with the Contractor and all subcontractors working on the same shift. No work shall be done on this contract on Sundays, or holidays. No work shall occur during holiday weekends; on the day before or the day after a long weekend which involves a holiday without prior approval by the Engineer.

The Contractor shall give notice to the Engineer at least 48 hours in advance of surfacing operations and shall not proceed without the approval of the Engineer.

Before starting any work on this Contract, the Contractor shall submit a schedule of operations as provided in Subsection 8.02.

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, in constructing or installing facilities alongside or near sewers, drains, water or gas pipes, electric or telephone conduits, poles, sidewalks, walls, vaults or other structures shall sustain them securely in place. The Contractor shall coordinate with the officers and agents of the various utility companies and municipal departments to assure that the services of these structures are maintained. The Contractor shall also be responsible for the repair or replacement,

at no additional cost to the Owner (Department), of any damage to such structures caused by construction operations. The Contractor is responsible to leave them in the same condition as they existed prior to commencement of the work. In case of damage to utilities, the Contractor shall promptly notify the utility owner and shall, if requested by the Engineer, furnish labor and equipment to work temporarily under the utility owner's direction. Pipes or other structures damaged by the operation of the Contractor may be repaired by the Department or by the utility owner, which suffers the loss. The cost of such repairs shall be borne by the Contractor, without compensation therefore.

If during construction there is an existing utility and/ or structure found to be in conflict with the proposed work under this Contract, the Contractor shall protect and maintain the services to the utilities and structures. The Engineer will, as soon as possible identify the utilities to be relocated or other such activities deemed suitable for resolution.

If live service connections are to be interrupted by excavations of any kind, the Contractor shall not break the service until new services are provided. Abandoned services shall be plugged off or otherwise made secure.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals for doing all the work involved in protecting or repairing property as specified in this Section, shall be considered included in the prices paid for the various Contract items of work and no additional compensation will be allowed therefore.

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 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.

NOTICE TO OWNERS OF UTILITIES (Supplementing Subsection 7.13)

Following are the names of owners and representatives of the principal utilities affected, but the Department does not guarantee completeness of the list:

Police

Uxbridge Police Department
Chief Scott Freitas
275 Douglas Street
Uxbridge, MA 01569
Telephone No. (508) 278-7755

Millville Police Department
Chief Ronald Landry
10 Central Street
Millville, MA 01529
Telephone No. (508) 883-3117

Fire

Uxbridge Fire Department
Steve Tancrell
27 South Main Street
Uxbridge, MA 01569
Telephone No. (508) 278-2787

Millville Fire Department
Chief John J. Mullaly
196 Main Street
Millville, MA 01529
Telephone No. (508) 883-4740

Telephone

Verizon
Karen Nunes
1166 Shawmut Avenue
New Bedford, MA 02746
Telephone No. (508) 991-3522

Electric

National Grid
Ayodele Osimboni
40 Sylvan Road
Waltham, MA 02451
Telephone No. (781) 907-3589

Gas

NStar Gas
Steven Owens
One NSTAR Way, SUMSE310
Westwood, MA 02090
Telephone No. (781) 441-8709

ExxonMobil Pipeline
Mark Whitt
145 Albany Street
Springfield, MA 01105
Telephone No. (413) 736-0239

Cable

Charter Communications
David Poplawski
640-D Lincoln Street
Worcester, MA 01605
Telephone No. (508) 853-1515

Fibertech Networks
James E. Highsmith
300 Meridian Centre
Rochester, NY 14618
Telephone No. (585) 697-5145

Public Works

Uxbridge DPW
Benn Sherman, Director
147 Hecla Street
Uxbridge, MA 01569
Telephone No. (508) 278-8616

Water and Sewer

Uxbridge DPW (Water & Sewer)
William Buma
147 Hecla Street
Uxbridge, MA 01569
Telephone No. (508) 278-8616

PRE-CONSTRUCTION CONFERENCE

The following agency representatives shall be contacted for the Pre-Construction Conference:

PROJECT MANAGER
Maury Tayarani, P.E.
Project Manager
MassDOT Accelerated Bridge Unit
10 Park Plaza
Boston, MA 02116
Telephone No. (617) 973-7583

DESIGNER
Thomas P. Daley, P.E.
Gannett Fleming, Inc.
199 Wells Avenue
Newton, MA 02459
Telephone No. (617) 528-7822, ext. 1004

Benn Sherman, P.E.
Director, Department of Public Works
Town of Uxbridge
147 Hecla Street
Uxbridge, MA 01569
Telephone No. (508) 278-8616

SAFETY CONTROLS FOR CONSTRUCTION OPERATIONS

(Supplementing Subsections 850.21 and 850.61))

Safety controls for construction operations shall be done in accordance with the relevant provisions of Section 850 of the Standard Specifications, the Manual on Uniform Traffic Control Devices, the Traffic Management Plan, and the following:

The providing of safety controls for construction operations shall be considered incidental to this contract and the costs for safety controls shall be included in the unit bid price for those contract items requiring such controls.

Positioning, adjusting and re-positioning of all devices such as traffic cones, high level warning devices, etc., not otherwise classified and paid for under other items in this contract, is considered incidental and no separate payment will be made.

PROPERTY BOUNDS

The Contractor shall exercise due care when working around all property bounds which are to remain. Should any damage to a bound result from the actions of the Contractor, the bound shall be replaced or realigned by the Contractor as directed by the Engineer at no cost to the Owner.

DRAINAGE

All new and existing drainage structures, including flared end sections, within the limits of this Contract shall be left in a clean and operable condition at the completion of the work.

Payment for the above work will be included in the contract unit prices under the pertinent drainage items. Debris as a result of the Contractor's operations shall be removed by the Contractor without compensation.

HOT MIX ASPHALT MATERIALS

Where the words "Bituminous Concrete" are shown on the plans, they shall be considered interchangeable with the words "Hot Mix Asphalt" at each occurrence.

TEMPORARY CONCRETE BARRIER

All concrete barrier for use as Temporary Concrete Barrier (Item 853.2) shall conform to MHD Standard Drawings M/E 403.1, 403.2, and 403.3. Barrier determined by the Engineer not to be in good condition shall be removed from the project.

ORDERING OF MATERIALS (Supplementing Subsection 6.03)

Within thirty (30) days following the execution of this Contract, the Contractor shall submit to the Engineer written proof that he has ordered all equipment he proposes to install. At that time, the Contractor shall also submit written confirmation of such order and delivery schedule(s) from the manufacturers of the various items. The delivery schedules shall be appropriate for timely completion of this project.

PUBLIC SAFETY AND CONVENIENCE (Supplementing Subsection 7.09)

The Contractor shall be required, without additional compensation, to provide safe and convenient access to all abutters during the prosecution of the work. Necessary access for fire apparatus and other emergency vehicles shall be maintained throughout the project at all times.

Sweeping and cleaning of all surfaces beyond the limits of the project to clean up material caused by spillage or vehicular tracking during the various phases of the work shall be considered as incidental to the work being performed under the Contract and there will be no additional compensation.

It shall also be a requirement that the Contractor supply to his/her personnel and require that they wear safety vests while working in or near the limits of this project at all times. All such vests shall remain the property of the Contractor. Any automotive equipment not protected by traffic control devices that is working on a public way under this project shall have one amber flashing warning light mounted on the cab roof or on the highest practical point of the machinery. This light shall be in operation while the equipment is so working.

When in the opinion of the Engineer, construction operations constitute a hazard to traffic in the area, the Contractor may be required to suspend operations and remove equipment from the roadway. The Engineer may also restrict or suspend operations on any roadway when in the Engineer's opinion this is warranted for the safety of the traveling public. The Contractor may also be required to suspend operations during certain hours and to remove the Contractor's equipment from the roadway at the direction of the Engineer.

PREVENTION OF WATER POLLUTION - SANITARY PROVISIONS (Supplementing Subsection 7.02)

During the performance of all Work done under this contract, the Contractor shall adopt such precautions in the conduct of his operations as may be necessary to avoid contaminating water in adjacent streams, ponds, rivers and wetland areas. All moving of equipment and other operations likely to create silting, shall be so planned and conducted as to minimize pollution in adjacent water resource areas. Water used for any purpose by the Contractor, which has been contaminated with soil, bitumen, salt or other pollutants shall be so discharged as to avoid affecting nearby waters. Under no circumstances shall the Contractor discharge pollutants directly into any water resource areas.

When the Contractor uses water from natural sources for any of his operations, intake methods shall be such as to avoid contaminating the source of supply and maintain adequate downstream flow when the source is a stream.

Erosion/Sedimentation Controls

All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the Contractor or his/her designee shall inspect erosion controls on a daily basis and shall remove accumulated sediments as needed. An adequate stockpile of erosion control materials shall be kept on site for emergency or routine repairs. The Contractor shall immediately control any erosion problems that occur at the site and shall also immediately notify the Resident Engineer who reserves the right to require additional erosion and/or damage prevention controls he/she may deem necessary.

Hazardous Spills

Supplies for cleanup of oil, gasoline and other hazardous materials to be used during the project shall be kept onsite at all times. Spills of reportable quantities of hazardous materials shall be reported, as required, to the department of Environmental Protection (DEP) and cleaned up in compliance with all DEP guidelines.

PRESERVATION OF ROADSIDE GROWTH (Section 8.08 shall be amended as follows)

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 ensure 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.

VALUE ENGINEERING INCENTIVE

A. This Subsection defines the conditions and requirements which apply to Value Engineering Change Proposals (VECPs) which are initiated, developed and submitted by the Contractor under the Department's Construction Phase Value Engineering (VE) Program to change the Drawings, Specifications or other requirements of the Contract. The purpose of the VECP Program is to encourage the Contractor to submit proposed changes to the requirements specified in the Accelerated Bridge Program contract documents, based on the Contractor's experience and knowledge of alternative, cost-reducing and/or time saving, means, methods, materials and technologies.

   Value Engineering is the systematic application of recognized techniques which identify the function of a product or service, establish a value for that function, and provides the necessary function reliability at the lowest practical lifecycle cost.

   VECPs submitted under the Contract shall require a change to the Drawings, Specifications or other requirements of the Contract Documents. As defined in Subsection D below, the incentive to the Contractor provided under this Subsection is to share the net savings resulting from acceptance of a VECP on the basis of fifty (50) percent for the Contractor and fifty (50) percent for the Department. In order to be considered for acceptance under this Subsection, each VECP shall:

1. Be identified by the Contractor at the time for submittal to the Engineer as submitted pursuant to this Subsection;

2. Yield a net savings in the cost of the instant Contract, as defined below, in excess of $100,000 One Hundred Thousand dollars;

3. Maintain the specified items' required functions such a s service life, reliability, economy of operation, ease of maintenance, and necessary standardized features and appearance; and

4. Shall not require an unacceptable extension of Contract Times or Contract Milestones.

B. Any VECP the Contractor submits shall be in sufficient detail to clearly define the proposed change. The Contractor's failure to provide material of the type, detail and in a format acceptable to the Engineer, and necessary to facilitate the Engineer's review, may be grounds for rejection of the VECP. Additionally, the Contractor will not be entitled to any equitable adjustment or increased Time, due to any aspect of any of the proposed VECP concepts; including no response(s) from the Department.

Initial information provided by the Contractor shall include:

1. A description of the difference between the existing and the proposed Contract requirements, and the comparative advantages and disadvantages of each;

2. Contract requirements recommended to be changed if the proposal is accepted;

3. Any changes in the Contract Time(s) or Contract Milestone(s) that will result from acceptance of the proposal accompanied by a contemporaneous schedule analysis;

4. A statement of the time by which the proposal must be accepted so as to obtain the maximum price reduction, noting any effect upon the Contract Time(s) and/or Contract Milestone(s).

5. A detailed estimate of the anticipated net savings will be calculated as follows:

    a. Calculate the cost of performing the construction activities in accordance with the contract documents as bid.

    b. Calculate the cost of performing the construction activities associated with the VECP.

    c. Estimate the costs of the Contractor required engineering, and the costs for the Designer of Record, to implement the proposed VECP. The Contractor

will be responsible to contract with the State's Designer of Record for all review time necessary to amend and approve the original design."

d. Estimate the Department's costs to perform engineering reviews and administer the VECP.

e. Estimate all costs associated with any revisions to other project related costs, such as Environmental Permits or Right of Way acquisitions.

f. The net savings to be split between the Department and the Contractor shall be calculated as follows:

a - (b+c+d+e) = net savings

6. The VECP shall be stamped by a professional engineer.

C. The Engineer may accept or reject part or all of any VECP by giving the Contractor. Approval of the VECP does not occur until a modification incorporating the VECP is issued by the Department and the Contractor re-certifies that to the current status of the originally proposed cost and/or schedule savings, to be provided within 5 days of the receipt of the Departments approval letter. Until such notice is issued, the Contractor shall remain obligated to perform the Work in accordance with the terms of the Contract Documents. VECPs will be processed expeditiously; however, the Department shall not be liable for any delay in acting upon any proposal submitted pursuant to this Subsection. The decision of the Engineer as to acceptance of any such proposal shall be final and shall not be subject to the dispute resolution.

The Contractor has the right to withdraw part, or all of any VECP, prior to acceptance by the Engineer. Such withdrawal shall be made in writing to the Engineer. The Contractor shall state the period of time from the date of submittal that each VECP shall remain valid. Revision of this validity period shall be allowed only by mutual agreement of the Contractor and the Engineer.

If the Contractor desires to withdraw the proposal prior to the expiration of this period, it shall be liable for the costs incurred by the Department in reviewing the proposal. If the Contractor withdraws the VEC Proposal, the Department reserves the right to proceed with the VECP or any portion of the VECP as a normal change and *the* Contractor waives any right it may have had to share in net savings hereunder. For purposes of this provision, expiration of the time established by the Contractor for approval shall be considered as withdrawal by the Contractor if the Department requests an extension of that time and the Contractor does not provide a written extension.

D. Prior to the VECP's final accepted by the Engineer, the Contractor shall provide a:

1. A Change Order, covering an Equitable Adjustment in the Contract Price and in any other affected provisions of the Contract, shall be issued and the draft

Contract changes shall be detailed in accordance with the provisions in these General Requirements.

2. The delineation of the shared net savings shall be determined by deducting from the estimated gross savings:
   - The Contractor's documented costs expended for developing the proposal for the accepted VECP;

As part of the final agreement of the shared savings, the Department will also provide an estimate of the additional costs incurred by processing and accepting ***the*** VECP which includes all anticipated increased costs to the Department on other Contracts and all anticipated follow-on increased costs to the Department, if any.

When a VECP submitted pursuant to this section is accepted by the Engineer, compensation shall be based on the following:

- The VECP will be implemented and paid using the cost and resource loaded schedule as the final negotiated costs to implement the VECP.

OTHER GENERAL REQUIREMENTS

Traffic Control - Detour

The proposed detour to be utilized as part of the temporary traffic control plan as shown in the contract documents requires that temporary construction signs be installed within the Town of North Smithfield, Rhode Island. The Contractor shall be responsible for contacting the Town of North Smithfield DPW in advance of any work to coordinate the placement of these signs. Contact information for the Town of North Smithfield is as follows:

Mr. Raymond Pendergast, Jr.
Director of DPW/Parks & Recreation
281 Quaker Highway
North Smithfield, RI 02896
(401) 762-0541

ExxonMobil Pipeline Coordination

If it is determined during construction that Balm of Life Spring Road is to be shut down in proximity to the location of the ExxonMobil pipeline crossing, the Contractor shall notify ExxonMobil in advance so that they can coordinate work efforts to dig up the pipeline and recondition it as preventive maintenance. This work will be performed by representatives of ExxonMobil Pipeline. An extension in the contract completion time will not be allotted for this work nor will any claims be considered due to any delays created by ExxonMobil's preventive maintenance operations. It shall be the Contractor's responsibility to ensure that this work is scheduled and performed within the allotted contract duration.

Utility Coordination

The Contractor is required to coordinate work with the local utilities to adjust, rebuild, reset or relocate all private utilities required by the scope of work and as directed by the Engineer. No additional compensation or extension of time shall be granted due to any delays that may result from failure to relocate utilities in a timely fashion.

Superstructure Girder Depth

The depth of the girders for the proposed folded plate system has been assumed based on discussions with the system developer. Any changes to the depth of the girders resulting from the final design by the Contractor's Engineer or Fabricator may result in significant revisions to other bridge elements and the contract documents. Such changes shall be documented by the Contractor on shop drawing submittals to be submitted to the Department for review. The cost of these changes and the required documentation shall be at the Contractor's expense. No consideration will be given to an extension in the contract time due to these changes.

REFERENCE STANDARDS

The Contractor shall 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 requirements of this Specification, follow the more restrictive requirements.

State Regulations

310 CMR 7.00 Air Pollution Control
310 CMR 30.00 Hazardous Waste Regulations
310 CMR 40.00 Massachusetts Contingency Plan
310 CMR 19.00 Solid Waste Management Regulations
314 CMR 1.00 - 30.00 Water Pollution Control Regulations

Federal Regulations

29 CFR 1910, Occupational Safety and Health Regulations for General Industry
29 CFR 1926, Occupational Safety and Health Regulations for the Construction Industry
40 CFR 50, National Primary and Secondary Ambient Air Quality Standards
40 CFR 58, Ambient Air Quality Surveillance
40 CFR 60, App. A, Method 22, Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Fires
40 CFR 265, Subpart D, Contingency Plan and Emergency Procedures

The U.S. Environmental Protection Agency (EPA)

SW 846 Test Methods for Evaluating Solid Waste - Physical/Chemical Methods
Method 1311, Toxicity Characteristic Leaching Procedure (TCLP)

American Society for Testing and Materials (ASTM)
D 4285 Detecting Oil or Water in Compressed Air

ITEM 100.01 SCHEDULE OF OPERATIONS – FIXED PRICE $50,000 LUMP SUM

The work under this item shall conform to the relevant provisions of Section 8.00 and Subsection 8.02 of the Standard Specifications, revised as follows, the Plans, and the following:

SUBSECTION 8.02 Schedule of Operations
Revise this Subsection to read as follows:
8.02 Schedule of Operations (Contract Progress Schedule)

A. General Requirements

The Contractor's approach to prosecution of the Work shall be disclosed to MHD by submission of the computerized, Construction Schedule required in this Section. These requirements are in addition to, and not in limitation of, requirements imposed in other sections.

The Contractor is advised that its schedules and reports, as specified herein, will be an integral part of the MHD's Accelerated Bridge Program management structure. The Contactor's schedules will be used by the Engineer to monitor project progress, plan the level-of-effort by its own work forces and consultants, and as a critical decision making tool. Accordingly, the Contractor shall ensure that it complies fully with the requirements specified herein and that its schedules are both timely and accurate throughout the life of the project.

This program requires the following schedule submittals by the Contractor:

- Contract Progress Schedule (Baseline, Statused, & Revised versions)
- Proposal Schedules
- Recovery Schedules
- Time Entitlement Analyses

The Contractor shall use computer software capable of preparing, statusing, and revising critical path method (CPM) schedules using precedence diagramming methods.

The software shall print activity reports and plot CPM time-scaled logic diagrams, sorted by structures, facilities, subcontractors, submittals, deliveries, change orders, and any other critical features of this Contract. Within ten (10) Work 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, change identification output, and is capable of supporting contemporaneous delay analysis, comparable to Primavera products. The Engineer shall notify the Contractor in writing, within seven (7) Calendar Days after receipt of the Contractor's notification on software, if there are any objections to the CPM software selected.

Item 100.01 Cont.

In conjunction with the requirements of Subsection 740 – Engineer's Field Office and Equipment, the Contractor shall provide to the Department one (1) copy of the approved scheduling software, licensed as required. This software shall be installed in the Resident Engineer's Field Office, and shall be State property.

Within 10 days after Contract award, and prior to submission of the initial baseline schedule, the Contractor shall host and conduct a schedule planning session. This session will be attended by MHD and its consultants. During this session, the Contractor shall present its planned approach to the project (including the Work to be performed by the Contractor and its subcontractors) including, but not limited to: the planned construction sequence and phasing; planned crew sizes; summary of equipment types, sizes, and numbers to be used for each work activity; estimated durations of major work activities; the anticipated critical path of the project and a summary of the activities on that critical path; a summary of the most difficult schedule challenges the Contractor is anticipating and how it plans to manage and control those challenges; and a summary of the anticipated quarterly cash flow over the life of the project. This will be an interactive session, and the Contractor shall answer all questions that MHD and its Consultants may have. The Contractor shall provide 5 copies of a written summary of the information presented and discussed during the session to the Engineer. The Contractor's initial Baseline Schedule Revision, 0 and accompanying schedule narrative, shall incorporate the information discussed at this schedule planning session.

B. Schedule Reviews

The Engineer will review the Contractor's schedule submittals and provide comments and disposition; either accepting the schedule or requiring revision and resubmittal of the schedule.

Schedules shall be resubmitted within ten (10) Work Days after receipt of the Engineer's comments.

The Engineer's comments may address whether items of the Work have been omitted, if activity durations are reasonable, or that the means, methods, timing, planned resources, 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.

Item 100.01 Cont.

C. Contract Progress Schedules

1. Baseline Schedule

No Application for Payment shall be approved by the Engineer beyond sixty (60) Calendar Days after Notice to Proceed until the Engineer accepts the Baseline Contract Progress Schedule, unless otherwise agreed to by the Engineer.

The Baseline Contract Schedule shall be submitted within thirty (30) Calendar Days after the Notice to Proceed (NTP) date. The Baseline Contract Schedule shall reflect the entire Work as awarded to the Contractor, and shall not include any delays or any Work involving Change Orders.

The Contractor shall provide a complete listing of all critical and near critical submittals within twenty (20) calendar days after Notice to Proceed. This listing will be required to be updated quarterly, and the critical submittals, shall be included and tracked in the Baseline Schedule and all Progress Schedule updates. This will include the contractor's planned submission date (of a complete submittal; incomplete submittals will not be partially accepted with regard to contract Time), the review period, resubmittals (for those more complicated submittals), and acceptance dates – all actual completion dates shall be provided in the Progress Schedule Update submissions.

The Baseline Contract Progress Schedule shall include all activities and content consistent with the requirements of this section. At a minimum, the Baseline Contract Progress Schedule, as well as all subsequent schedules, 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) All components of the Work – consisting a multiple activities defined by type of work, location, phase, etc.
3) Procurement of permits by the Contractor or the Engineer
4) Submittal preparation and submission
5) Submittal review and return - thirty (30) Calendar Days
6) Material and equipment procurement, fabrication, and delivery to the site or storage location.
7) Interfaces with adjacent work, utility companies, public agencies, and/or any other third party work affecting this Contract
8) Interim Milestones listed in Subsection 8.03 or elsewhere in the Special Provisions
9) The critical path, clearly defined and labeled
10) Float, as defined below, clearly identified
11) Traffic Set-up, zone removal, nightwork, and phasing
12) Substantial Completion
13) Punchlist completion period
14) Final Acceptance

Item 100.01 Cont.

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. The float may be claimed by whichever party first demonstrates a need for it, i.e., that Contract Milestones and/or the Contract Completion Date, has been delayed The Contractor shall demonstrate this need as required herein.

The Baseline Contract Schedule shall consist of the electronic data and reports specified herein.

The Baseline Contract Schedule shall be prepared in the approved electronic format described above and shall be submitted in two formats; printed on 11" X 17" sized paper and copied on a portable electronic data storage medium.

Once the Baseline Contract Schedule has been accepted by the Engineer, with or without comments, it will represent the as-planned schedule for the Work. It shall be known as the Baseline Schedule and shall be the Contract Progress Schedule of Record until such time as the schedule is revised under Subsection 8.02.C.3.

2. Requirements for all Schedules

All schedules shall conform to the following requirements:

a) RESOURCES: As part of the Baseline and Schedule Update, the Contractor is required to provide a detailed narrative of the planned resources for each major operation. This requirement will be provided to validate the original plan, monitor the progress, and to analyze delays.

b) LOGIC: All schedules 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 8.06 – Limitations of Operations of Division I, Special Provisions.

c) ACTIVITIES: All schedules shall clearly and separately define the progression of Work from Notice to Proceed to Final Acceptance by using separate activities for (i) all Work components; (ii) the procurement of permits (by the Contractor or Engineer); (iii) submittal preparation and submission; (iv) submittal review and return, thirty (30) Calendar Days; (v) material and equipment procurement and delivery to the site or location of storage; (vi) interfaces with adjacent work (other public agencies, private owners, and utility companies); (vii) interim milestones listed in Subsection 8.03 of Division I, Special Provisions; (viii) Substantial Completion; and (ix) Final Acceptance.

Item 100.01 Cont.

d) EARLY & LATE DATES: Early Dates shall be based on proceeding with the Work, or a designated part of the Work, exactly on the date when the corresponding Contract Time commences. Late Dates shall be based on completing the Work, exactly on the corresponding Contract Time, even if the Contractor anticipates early completion.

e) 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 Subcontractor require to perform the related work. In general, installation Activities shall be detailed in a manner that utilizes planned durations from ten (10) to thirty (30) Business Days, and have a value not exceeding $50,000. Activity durations, greater than 30 working days shall be kept to a minimum, and must be approved by the Engineer, except in the case of nonconstruction activities such as procurement of materials, delivery of equipment, and concrete curing. Submittal Review Activities shall be thirty (30) Business Days, unless different review times are specified in other sections of the Contract Documents

f) ITEMS TO BE PAID: The Contractor shall specifically identify in the Baseline and the Contract Progress Schedules all items of permanent materials and equipment (materials on hand) for which the Contractor intends to receive payment, in accordance with Subsection 9.04 - Partial Payments, prior to the incorporation of such items into the Work.

g) ACTIVITY IDs AND CODES: The Contractor shall use standard activity identification numbers, activity codes, and activity descriptions in all Contract Progress Schedule submittals as specified below.

Activity Identification Numbers

The Contractor shall use the following standard activity identification numbering system for all activities.

```
 ###-########
|     |
|     |
|     +------ Sequential Numbering Code
|
|
+------ LAST 3 of the Contract Number
```

CONTRACT NUMBER: The first six characters of the activity identification number shall consist of a “C” for Contract followed by the five-digit MassHighway contract number.

Item 100.01 Cont.

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, and/or any other type of information that the Contractor wishes to include in its activity identification numbering code.

Activity Codes
The Contractor shall use the following sortable standard activity codes to further define its schedule's activities.

Code	Code Description
DIST	MassDot District Number
TOWN	Town Name
MSNO	Contract Milestone Number Designation
BIDI	Bid Item Number Designation
STRUC	Type of Structure Designation
RESP	Organization Responsibility Code
OTHR	Other Field

DIST – MassHighway District Number: A one digit code corresponding to the MassHighway District in which the project is located.

	Code Value	Code Value Description
Example:	5	MassDot District 5

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

	Code Value	Code Value Description
Example:	MANS	Mansfield

Item 100.01 Cont.

MSNO – Contract Milestone Number Designation: A two digit code corresponding to the Contract Milestone number contained in Subsection 8.03 of Division I, Special Provisions that is at the end of the activity's sequence chain.

	Code Value	Code Value Description
Example:	03	Milestone No. 3 – Substantial Completion

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

	Code Value	Code Value Description
Example:	975.3	Metal Bridge Railing
	PCM	Activity added by Proposal or Contract Modification

PROJ – Primary Project Type: A one or two 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.

	Code Value	Code Value Description
Example:	BC	Bridge Reconstruction / 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
	TS	Traffic Signals
	TU	Tunnels
	U	Utilities
	V	Vertical Construction (Chapter 149)

Item 100.01 Cont.

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

	Code Value	Code Value Description
Example:	MIW	McGillicuddy Iron Works
	BCEC	Bay City Electric Company
	MDR	MassDot – Rail & Transit Division
	CSX	CSX Railroad Corporation
	RE	MassHighway Resident Engineer
	MDH	MassDot - Highway Division

OTHR – Other Field: An eight 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.

	Code Value	Code Value Description
Example:	XXX	A description of something other than the above

ACTIVITY DESCRIPTIONS
The activity description shall 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.

h) NOT TO BE USED: Unspecified milestones or restraint 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 of Division I, Special Provisions shall not be used in the Contractor's Progress Schedule.

3. Contract Progress Schedule Submittal - Reporting Requirements

Both the initial and revised versions of the Contract Progress Schedules shall be submitted for review under the guidelines developed below.

Item 100.01 Cont.

The Contractor shall uniquely identify each Contract Progress Schedule Submittal. Resubmissions shall use the same revision number, followed by the letters A, B, C, and so on, and shall fully address and comply with the Engineer's review comments.

Contract Progress Schedule submittals, including resubmissions and revisions, shall include one (1) complete electronic file copy of the Contract Progress Schedule in an electronic format acceptable to the Engineer and one (1) copy of the following reports and graphs acceptable to the Engineer:

a. The schedule narrative 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) give progress highlights and quantify Work Days gained or lost versus the Contract Progress Schedule Revision of Record; (iv) describe delays, and the Contractor's plan to recover schedule, if appropriate.

The Contract Progress Schedule and Revised Contract Progress Schedule narratives shall: (i) describe resources to be employed on all remaining Work (consistent with or explaining variances from the resource/manhours identified in the specific schedule activities – loaded into the schedules); any deviation from the original plan (ii) describe the Contractor's plan and approach, methodologies and resources to be employed, as represented in the Contract Progress Schedule, for completing the various operations and elements of the Work; (iii) itemize shifts, Holidays, and if multiple calendars are applied to the activities, uniquely identify each calendar; (iv) itemize and explain any proposed changes made in activities, logic ties and restraints. This last item applies to Revised Contract Progress Schedules only.

b. A time-scaled logic diagram on 11x17 sheets, showing the previous month schedule Gantt chart overlay (otherwise known as a target comparison) and the previously approved schedule if applicable/as requested, showing current duration, previous duration, current float, previous float, current and previous Early Start, Late Start, Early Finish, Late Finish, and with current logic ties displayed. These 11x17 sheets are to be organized to be consistent with the activity codes described in Subsection 8.02.C. and shall be provided for each type of schedules submission contained herein. Activities shall be linked by logic ties and be shown on the Early Dates. The Critical paths shall be highlighted and Total Float shall be shown for all activities.

4. Revised Contract Progress Schedules

Upon review and acceptance by the Engineer of activities and logic ties in Proposal Schedules, prepared in accordance with Subsection 8.02.C.6, and Recovery Schedules prepared in accordance with Subsection 8.02.C.7, such activities shall be incorporated into the next Statused Contract Progress Schedule as a Revised Contract Progress Schedule. All schedule changes shall be developed in accordance with Subsection 8.02.C. A Revised Contract Progress Schedule shall be due with the Application for Payment following the Engineer's acceptance of the schedule changes and shall consist of the required electronic data and reports specified in Subsection 8.02.C.4, as supplemented below.

Item 100.01 Cont.

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 in the schedule must be fully described in an accompanying narrative.

Revised Contract Progress Schedules shall be prepared in the approved electronic format described above and shall be submitted in two formats; printed on 11" X 17" sized paper and copied on a portable electronic data storage medium.

Once a Revised Contract Progress Schedule has been returned by the Engineer to the Contractor as "Resubmittal Not Required", with or without comments or objections noted, it shall become the Revised Contract Progress Schedule of Record, meaning it is to be used for subsequent Statused Contract Progress Schedules, and shall be referred to by its revision number.

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

5. Statused Contract Progress Schedule Requirements

Statused (updated) Contract Progress Schedules shall be submitted by the Contractor coinciding with the first Contract Quantity Estimate (CQE or "pay estimate") of each month. Except as provided elsewhere in this subsection, Statused Contract Progress Schedules shall update and replace the Contract Progress Schedule of Record.

A Statused Contract Progress Schedule shall consist of the following:

1. A Schedule Narrative consistent with Subsection 8.02.

2. All documentation required by the Contract to support the CQE.

Each Statused Contract Progress Schedule shall reflect updated progress to the status date, shall forecast the finish dates for in-progress activities and remaining activities, but shall not change any activity descriptions, durations, or sequences of work, planned resources, or costs, 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.

Statused Contract Progress Schedules shall be prepared in the approved electronic format described above and shall be submitted in two formats; printed on 11" X 17" sized paper and copied on a portable electronic data storage medium.

Item 100.01 Cont.

No CQE shall be approved by the Engineer until the Contract Progress Schedule has been submitted.

6. Proposal Schedules & Time Entitlement Analyses

Proposal Schedules and Time Entitlement Analyses (TEAs) shall be developed in accordance with this Subsection when the Contractor's operations are materially affected by changes in the Plans and/or if requested by the Engineer. The Contractor shall submit a Proposal Schedule or TEA within ten (10) Work Days following the Engineer's request or within ten (10) Work Days from the initial occurrence which caused a deviation from the current Contract Progress Schedule of Record. This required ten (10) Work Day period may be extended as necessary subject to acceptance by the Engineer. The Proposal Schedule or TEA shall be developed using duplicate electronic files of the current Contract Progress Schedule of Record.

Proposal Schedules and TEAs shall also be used by the Contractor to negotiate with the Engineer the schedule impact of an Extra Work Order (EWO.) Proposal Schedules and TEAs shall (i) incorporate all proposed activities and logic ties required to implement the EWO, (ii) detail all impacts on pre-existing activities and logic ties, and (iii) detail the actual resources expended for past critical path activities, with a comparison vs planned resources/manhours, (iv) detail the planned resources required to complete the EWO, (v) attach separate time-scaled logic diagrams with the proposed and pre-existing activities and logic ties involved in or affected by each EWO.

Proposal Schedules and TEAs shall consist of the submittal requirements specified in Subsection 8.02.C.2. Furthermore, Proposal Schedules and TEAs shall accurately reflect all revisions and/or adjustments made to activities, logic ties and restraints that are necessary to reflect the Contractor's current approach for Work remaining.

Proposal Schedules and TEAs shall be prepared in the approved electronic format described above and shall be submitted in two formats; printed on 11” X 17” sized paper and copied on a portable electronic data storage medium.

Accepted changes shall be submitted as "Revised Progress Schedules" per the requirements of Subsection 8.02.C.3.

7. Recovery Schedules

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

The Contractor shall promptly develop a Recovery Schedule whenever one of the following occurs:

Item 100.01 Cont.

1.) The Contract Progress Schedule of Record's critical path exceeds the greater of:
   a) A delay of twenty (20) Calendar Days, or
   b) A delay equal to 5% of the Work Days remaining until the Contract Completion Date;

2.) The Contractor cannot comply with the Contract Progress Schedule of Record;

3.) The Engineer requests it. If requested by the Engineer, the Contractor shall submit a separate Recovery Schedule, prepared in accordance with Subsection 8.02B, within ten (10) Work Days and submit it no later than the submittal of the next Statused Contract Progress Schedule.

Recovery Schedules shall be used by the Contractor to notify the Engineer of revisions to logic ties and activities of the Contract Progress Schedule of Record. Recovery Schedules shall include a separate time-scaled logic diagram of the activities impacted and a narrative describing the causes of any delay and the actions planned, and resources required, to recover schedule to meet the Contract Completion Date. Recovery Schedules shall be prepared in the approved electronic format described above and shall be submitted in two formats; printed on 11" X 17" sized paper and copied on a portable electronic data storage medium. Failure to submit a Recovery Schedule could result in withholding of full or partial Contract Quantity Estimate payments by the Engineer.

8. Disputes
As stated in Subsection 8.02 it is the intent of this Contract that all schedules be submitted, reviewed, dispositioned, and accepted in the timely manner specified 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 Subsection 8.02.

Basis of Payment
The project requires all Project progress submittals specified in Section 8.02 of the Supplemental Specifications and Item 100.01 SCHEDULE OF OPERATIONS - FIXED PRICE $50,000 that the Contractor shall provide as specified above. A fixed price of $50,000 will be provided to the contractor for these Project Schedule Submittal requirements. The Contractor is advised and/or cautioned that this "fixed price" value is separated from what the Department considers to be the Contractors indirect/general condition costs for payment purposes only and, if the Contractor deems it necessary to include additional costs to provide all of the requirements of this section, these additional costs should be included in the Contractor's general conditions. Note: This Fixed Price payment item is added to the Departments bid form with this predetermined and/or fixed amount. Each bidder is directed to add and/or include this fixed price bid item value to the total bid value – failure to do so will be grounds for the rejection of the bid.

Payment will be made under Item No. 100.01, SCHEDULE OF OPERATIONS - FIXED PRICE $50,000, with the following breakdown:

Fifteen percent (15%) of the FIXED PRICE will be made upon return to the Baseline Construction Contract Schedule as "Resubmittal Not Required" (As-Planned Schedule). The remaining (85%) will be pro-rated in equal monthly amounts on each subsequent application for payment upon the Engineer's receipt and acceptance of the monthly schedule update submittals. The number of months to be used for the pro-rating will be the number of months estimated to complete the work.

All payments are subject to retainage.

ITEM 102.51 INDIVIDUAL TREE PROTECTION EACH
ITEM 102.52 TEMPORARY TREE PROTECTION FENCE 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 (3 meters) 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 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.

Item 102.51 & 102.52 Cont.

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 (2.4 meters) 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 (1.2 meters) and supported by steel or hardwood stakes spaced at a maximum of 8 feet (2.4 meters) 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 activates 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.

Item 102.51 & 102.52 Cont.

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 (3 meters) 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 (150 mm) 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 (2.4 meters) 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.

Item 102.51 & 102.52 Cont.

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.

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.

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.

Item 102.51 & 102.52 Cont.

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 115.1 DEMOLITION OF BRIDGE NO. U-02-030 LUMP SUM

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

The work under this item shall include the removal and satisfactory disposal of the entire superstructure in accordance with Section 112.61 of the Standard Specifications, and the removal and satisfactory disposal of the existing abutments and pier to the extent indicated on Sheet 7 of 18. The void left in the river bed by the removal of the existing pier shall be filled using stone meeting the requirements of Material Section M2.02.3.

The work shall also include the removal and satisfactory disposal of the metal post, timber railing on both sides of the bridge. The timber components of the existing structure are suspected to be treated with creosote, pentachlorophenol and/or CCA. Refer to the Special Provision for Disposal of Treated Wood Products for sampling, testing and disposal requirements for this treated timber.

The Contractor shall develop a demolition plan to include details of a temporary shield to be installed under the bridge deck to protect Ironstone Brook from any falling debris during construction. These plans shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts and shall be submitted to the Engineer and MassDOT's Environmental Office for approval prior to the start of construction. The Contractor's design shall consider the use of equipment and operation methods for shoring, formworks, debris and fall protection to avoid any contamination of Ironstone Brook. All work shall be conducted in conformance with all environmental regulations and requirements.

The Contractor's design shall not reduce the hydraulic opening under River Road below the 10-year flood elevation.

Item 115.1 Cont.

The Contractor is reminded that all utility coordination and emergency service contact shall be made in advance of any bridge demolition work so as not to create any delays in the project schedule. Claims for delays in the demolition of the existing bridge structure due to the Contractor's failure to notify and coordinate with the affected agencies will not be considered.

BASIS OF PAYMENT

Payment for work under this Item shall be paid at the contract lump sum bid price, complete.

Payment for all bridge demolition work, including design and installation of the temporary shielding, shall include all labor, tools, equipment and materials necessary for removing the existing structure to the limits shown on the contract plans or specified elsewhere in the contract documents. Payment shall also include the cost of filling the void left in the river bed by the removal of the existing pier. This work shall include the satisfactory removal and off-site disposal of the bridge abutments, center pier, superstructure, wingwalls and approach slabs. Payment will also include work for the removal and disposal of the existing railings on the bridge including any untreated wood elements. Disposal of treated wood railing will be paid under Item 184.1.

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, taxes, special handling of hazardous materials, etcetera, shall be included in the bid price of the demolition item.

Payment for installation of steel sheeting, and the installation of cofferdams and other measure for control of water will be paid under the respective items included in the contract.

ITEM 120. EARTH EXCAVATION CUBIC YARD

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

The work shall also include the removal and satisfactory disposal of rubbish and debris; bituminous concrete pavements; gravel subbases; topsoil strippings; and other existing items that will not be reused such as damaged curbing and edging. Unless otherwise specified, excavated bituminous concrete pavement, curbing, edging and other items that will not be reused and shall become the property of the Contractor.

Edges of excavations made in existing pavements shall be squared by sawcutting with power-driven tools to provide a neat, clean edge for joining new pavement, as shown on the Plans. Ragged, uneven edges will not be accepted. Pavement areas that have been broken or undermined shall be edged neatly with a minimum disturbance to remaining pavement. Payment for sawcutting work shall be made under Item 482.3.

Item 120. Cont.

This item shall include excavation of material suitable for embankment, subgrade and subbase material. Excavated material meeting the requirements of 150.40 of the Standard Specifications for its specific use, as determined by the Engineer, shall be reused under this Contract for the formation of embankments, roadbeds, foundations or backfill in accordance with the relevant provisions of Sections 150 and 170.

If the Contractor, for his/her own convenience, desires to stockpile excavated material suitable for the formation of embankments or other uses requiring material meeting M1.01.0, he/she may do so in accordance with Section 150, within the project limits.

The Contractor shall not be paid for stockpiling excavated material within or outside the project limits. Materials excavated and stockpiled for reuse under this Contract will not be paid for as borrow in addition to its original payment as excavation. The Contractor shall not be paid for replacement borrow material if he/she desires to waste suitable excavated material for his/her own convenience. The Contractor may waste excavated material only after obtaining written approval of the Engineer in accordance with Section 150.20.

Excavation of materials for the construction of Mechanically Stabilized Earth Walls within the limits shown on the contract plans will not be included under this item. Payment for earth excavation within these areas will be included under Item 996.31.

Earth Excavation 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 151. GRAVEL BORROW CUBIC YARD

Work under this Item shall conform to the relevant provisions of Section 150 of the Standard Specifications and the following:

Gravel Borrow shall conform to M1.03.0 Type b.

ITEM 156.13 CRUSHED STONE FOR INTEGRAL ABUMTMENT PILES TON

This Item shall conform to the relevant provisions of section 150 of the Standard Specifications as modified by the following:

Material
Crushed Stone shall conform to the material requirements of M2.01.6 of the MassDOT Highway Division Standard Specifications.

Item 156.13 Cont.

Construction

At each pile, a 30" diameter hole shall be pre-augured to the pile depth as shown on the plans below the bottom of the pile cap. The crushed stone shall be deposited with as little compaction as possible in the locations shown on the Plans. The pre-augured holes shall be filled with un-compacted crushed stone after installing the piles.

Crushed Stone shall be placed in the pre-drilled pile holes after placing piles in the cemented rock sockets. The crushed stone shall not be placed until the rock socket concrete has set. The crushed stone compacted in layers not exceeding 6 inches. Compaction shall be to 98 percent of the maximum dry density of the material or shall be judged to be firm and stable to the satisfaction of the Engineer.

Method of Measurement

Measurement and payment shall adhere to the relevant provisions of section 150 of the Standard Specifications. Measurement shall be by the Ton complete in place. No overhaul allowance will be made. The weight slips shall be countersigned on delivery by the Engineer, and any weight slip not so countersigned shall not be included for any payment under the Contract.

Basis of Payment

Crushed stone for integral abutment piles shall be paid for at the Contract Unit Price per Ton, complete and in place.

Payment for all excavation necessary for the placement of the crushed stone will be included under Item 944.2, Predrilling for Piles.

ITEM 160.109 INSTRUMENTATION LUMP SUM

DESCRIPTION

The work under this section includes furnishing, calibrating, installing bridge instrumentation and protecting it from damage. The bridge instrumentation consists of the following items:

- Strain Gages Embedded
- Strain Gages Weldable
- Pressure Cells
- Tiltmeters
- Displacement Transducer
- Data Acquisition System
- Solar Power Source and Connection
- Phone/Electric Service Connection

Item 160.109 Cont.

All related materials to these items such as signal cables, protective tapes and angles, etc shall be included in the definition of the item itself.

Other related work specified elsewhere and not part of this item is as follows:

- Services Connection Item #813.81
- Junction Boxes 12" x 12" x6" Item # 811.61
- 3" Electric Conduit Type NM-Plastic (UL) Item # 804.3
- Control Cabinets and Foundation Item # 812.50

Responsibilities of the Contractor

Furnish components of instrumentation that are to be installed during construction and as specified on the plans.

Calibrate all instruments as specified herein.

Install all instruments as per the plans and in accordance with the specifications.

Protect from damage and maintain instruments during and after installation by the Contractor and repair or replace damaged or inoperative instruments during installation.

Perform initial readings of the instruments in accordance with the specifications.

Provide safe access to the Engineer and UMass representatives for inspection and data collection.

Provide 2 week notice to UMass and MassDOT prior to construction activities listed as required data readings.

Allow 3 day window for UMass representatives to acquire data prior to advancing the construction sequence.

Qualifications of Contractor's Instrumentation Personnel

The Contractor's instrumentation personnel who are responsible for installing, calibrating and maintaining instrumentation as required shall have the qualifications specified herein. The contractor's instrumentation personnel shall include a qualified instrumentation Engineer or specialist who is a registered Professional Engineer in the Commonwealth of Massachusetts and who has at least 4 years of experience in installation and monitoring of the types of instruments specified herein. The instrumentation Engineer shall:

Item 160.109 Cont.

Prepare detailed step-by-step installation, calibration and maintenance procedures for all instruments specified herein. These procedures shall be submitted to the Engineer for review forty five (45) days prior to installation.

Be on site and supervise at least the first two installations of each type of instrument.

Conduct the pre-installation and post-installation acceptance tests for at least the first two of each type of instrument specified herein.

Be on site until the completion and acceptance by the Engineer of the tasks outlined above and subsequently be available for consultation at all times for the duration of the contract.

Responsibilities of Fabricator

End blocks for strain gages and embedded strain gages must be installed in the fabrication shop. The contractor has the option of completing installation of strain gages in the fabrication shop or field.

Gage attachments to galvanized plate material requires grinding to remove galvanizing. This should be limited to the minimum area required for attachment of gages. This includes strain gages, and displacement transducers. After welding required for instrumentation is completed the area should be repaired. Fabricator is to recommend procedures and timing of the steps required. Procedures must be approved in writing by the Engineer.

Embedded concrete gages must be placed into the concrete deck prior to placement of concrete in accordance with instrumentation drawings and manufacturer recommendations.

Locations of each gage installed including serial number must be documented and communicated in writing to MassDOT and UMass.

Fabricator must provide adequate measures to ensure protection of instrumentation during transport and delivery. Repair and replacement of damaged or inoperative instruments due to transport and delivery is the responsibility of the fabricator; however, it shall be the Contractor's responsibility to ensure that damaged or inoperative instruments are repaired or replaced to the satisfaction of MassDOT. In the case of inaccessible instruments (embedded strain gages) MassDOT will determine required actions. External gages may be an acceptable replacement method.

Item 160.109 Cont.

Quality Assurance

A factory calibration shall be conducted on all instruments prior to shipment. Certification shall be provided to indicate that the test equipment used for this purpose is calibrated and maintained in accordance with the test equipment manufacturer's calibration requirements and that, where applicable, calibrations are traceable to the National Institute of Standard and Technology.

Calibrations shall be made on each instrument to be installed. The variable parameter being measured shall be calibrated for increasing and decreasing loading, movement or temperature conditions as applicable for at least two (2) cycles throughout the maximum range expectation to occur in the field in order to document hysteresis. Reading should be taken at about ten (10) equal increments and the manufacturer shall supply a calibration curve with data point clearly indicated and tabulation of data. A unique identification number shall be marked on each instrument and corresponding calibration curve.

A final quality assurance inspection shall be made prior to shipment. During the inspection a checklist shall be completed to indicate each inspection and test detail. A completed copy of the checklist shall be supplied with each instrument.

Calibrations shall be conducted under several different temperatures to evaluate the efforts of temperature on the instruments and verify calibration changes with temperature.

Coordination Meeting

Following submittal of the installation procedure by the Contractor and the review by the Engineer and prior to the installation of any instrumentation, a meeting shall be held between the Contractor, the Instrumentation Engineer and the Department representatives (Geotechnical and Bridge Sections) and UMass representative for the purpose of reviewing and detailing the plan of work.

The UMass representatives will provide technical support to MassDOT during construction. The Contractor will be required to provide the UMass representatives copies of construction schedules and notifications of upcoming events. These requirements and others will be discussed at the initial coordination meeting. Contact information for UMass representatives is as follows:

Scott A. Civjan, Ph.D., P.E.
232 Marston Hall
Dept. of Civil and Environmental Engineering
University of Massachusetts Amherst
130 Natural Resources Road
Amherst, MA 01003-9293
Tel. No.: (413) 545-2521

Sergio F. Breña
232 Marston Hall
Dept. of Civil and Environmental Engineering
University of Massachusetts Amherst
130 Natural Resources Road
Amherst, MA 01003-9293
Tel. No.: (413) 545-0349

Item 160.109 Cont.

Installation Schedule and General Requirements

The following are required with respect to timing of instrumentation installation:

- Embedded slab concrete gages and end blocks installed in the shop with setting tools must be provided to the fabricator prior to fabrication. The contractor has the option of completing installation of strain gages in the fabrication shop or field.
- Data Acquisition pad, electrical enclosure, solar panel and wiring shall be completed immediately after setting of folded plate beams or earlier.
- Data Acquisition shall be fully operational prior to road surfacing.
- Verification of functioning instrumentation and equipment is required prior to placement of closure pours. Any equipment needing replacement or cable splicing shall be replaced prior to placement of closure pours.
- Tiltmeters on abutments shall be placed prior to girder placement.
- Tiltmeters and pressure cells on end diaphragms shall be placed prior to backfilling operations.
- Tiltmeters require protective cover (steel angle with end caps) to avoid contact with soil.
- Compaction around pressure cells should be provided by hand methods with care to avoid damage.
- Strain gages on girders may be placed in the fabrication shop, in the field prior to or in the field immediately subsequent to girder placement, with cables routed to data acquisition pad enclosure. Written communication to MassDOT shall report the girder support conditions and field conditions when gages were installed.
- Concrete embedment gages shall be placed prior to placement of closure pours.
- Any damaged or severed cables shall be spliced using fully waterproof methods per the manufacturer recommendations.
- Gages may require protective covering – these shall be provided per manufacturer requirements.
- Any gages or related materials damaged during construction shall be replaced by the contractor at no additional charge to the Department. The Data acquisition system shall be installed after all instrumentation has been installed and prior to bridge opening. In addition to the initial readings specified above one set of initial readings shall be taken by the Contractor of all instruments concurrently following substantial completion of the bridges and Data acquisition System and prior to opening the bridge. The schedule of these readings shall be as directed by the Engineer. Following acceptance by the Engineer of the initial reading subsequent instrumentation reading shall be performed by the UMass representatives.

Item 160.109 Cont.

Construction Data Reading Schedule

One week notice must be provided to MassDOT and UMass representatives prior to data reading times noted. The following are required with respect to timing of instrumentation readings:

- Initial readings shall be taken immediately subsequent to installation of each instrument.
- Gages installed at the fabrication shop shall include verification of functioning gages prior to shipping of components.
- Readings shall be taken immediately prior to each of the following construction sequences
    a. girder placement
    b. closure pour placement
    c. end diaphragm placement
    d. deck placement
    e. backfill operations
- Data collection (all gages) shall be collected at a minimum of 3 equally spaced (with respect to earth fill volume) intervals during backfilling operations.

Shipment and Delivery of Instruments

It shall be the responsibility of the Manufacturer to guarantee timely delivery of the instruments.

The Instrument Engineer shall inspect all instruments to ensure that no damage has occurred during shipments as well as to make sure the exact quantity of instruments ordered has been received.

It shall be the responsibility of the Manufacturer to replace any instrumentation damaged or lost during shipment and delivery.

Storage of Instruments

All instrumentation material, after receipt at the site and prior to installation, shall be stored in an indoor, clean, dry, and secure storage space. Instruments shall not be exposed to temperatures outside the manufacturer's stated working temperature range.

Any instrument that is damaged during storage or installation shall be replaced by the contractor at no additional charge to the Department.

MATERIALS

All materials shall be new. All instruments shall operate using vibrating wire technology. All instrumentation related products shall be from the same source to ensure compatibility unless accepted by the Engineer in writing.

Item 160.109 Cont.

Any products specified by brand name and model number shall be furnished by the Contractor as specified to be used in the work. In the event where the Contractor considers substitution of the specified product, contractor shall submit to the Engineer complete comparative data for consideration and approval. Substitute products shall not be ordered, delivered to the site, or used in the work unless accepted by the Engineer in writing. The Engineer will be the sole judge of the suitability and equivalency of the proposed substitution.

Any request from the Contractor for consideration of a substitution shall clearly state the nature of the deviation from the product specified.

The Contractor shall furnish all installations tools, materials and miscellaneous instrumentations components required for the proper installation of all instruments.

Modifications to standard instrumentation connection details may be required and shall be developed with the approval of the instrument manufacturer and Engineer.

Design Engineer must verify expected movements and readings are within instrument range.

For each instrument type, the Contractor shall provide from the Manufacturer three (3) copies (for Installer, Engineer and UMass personnel) of instruction manual which shall include the following information when applicable:

A description of the purpose of the instrument and the theory of operation.

Step-by-step procedures for pre-installation test to insure that the instruments are functioning correctly prior to installation.

A list of calibration equipment required, and recommended frequency of calibration.

Step-by-step instrument installation procedures including materials, tools, spare parts, and post-installation acceptance tests.

Maintenance procedures which shall include any regular maintenance procedures, frequency of required maintenance, recommended spare part list, list of part numbers and manufacturers of standard parts, troubleshooting guide to include a list of failure indications and probable cause and correction action requirements for each failure.

Item 160.109 Cont.

Data collection procedure which shall include:

- Step by Step procedures for equipment setup and turn-on and functional explanation of each connector.
- Cautions pertaining to personnel and equipment.
- Statement of procedure for obtaining initial readings.
- Statement of procedure for obtaining readings subsequent to initial readings.
- Statement of construction or environmental factors that might cause any changes in measured data.
- List of equipment and tools required during reading.

Data processing, presentation and interpretation procedures that shall include data calculations sheet, step by step calculation procedures including an instruction manual for any computer program supplied by the Manufacturer, sample data calculation and data plots ans notes in interpretation.

Weldable Strain Gages

Strain gages are to be installed on bridge girders in quantity and at the locations as specified in the plans. The Contractor shall provide the following items as specified herein:

Provide vibrating strain gages, model 4000 as manufactured by Geokon Inc., model SM-5 as manufactured by Roctest, model ST2-1 as manufactured by Geo-Instruments/Soil Instruments LTD, or acceptable equivalent. Gages shall have documented long-term stability over a three-year period, and shall be proof tested by submersion in water for 24 hours at 100psi. Strain gages shall have end blocks arranged for arc welding to steel, with the minimum center-to-center spacing of 3 inches, and shall be fitted with thermistor.

Strain Gages – Embedment Type

Strain gages are to be installed in concrete slab at fabrication shop and in closure pours in quantity and at the locations as specified in the plans. The contractor shall provide the following items as specified herein:

Provide vibrating wire strain gages, model 4200 as manufactured by Geokon, Inc., model EM-5 as manufactured by Roctest, model ST4-1 as manufactured by Geo-Instruments/Soil Instruments LTD, or acceptable equivalent. Gages shall have a documented long-term stability over a three-year period, and shall be proof tested by submersion in water for 24 hours at 100psi. Strain gages shall be the type with vibrating wire transducers, and shall be fitted with a thermistor. Strain gages shall be attached to reinforcement in such a manner as to ensure final location of gage and not interfere with the proper functioning of the gage.

Item 160.109 Cont.

Pressure Cells

Pressure cells are to be installed on the back of the abutments in quantity and at the locations as specified in the plans. The Contractor shall provide the following items as specified herein.

Provide pressure cells, model 4815 as manufactured by Geokon Inc., model TPC as manufactured by Roctest (requires modification for application to concrete and granular fill interface), model P6 as manufactured by Geo-Instruments/ Soil Instruments LTD (requires modification for application to concrete and granular fill interface) or acceptable equivalent.

The pressure cells shall have a maximum pressure range of 170KPa. Pressure cells shall be the type with vibrating wire transducers, and shall be fitted with a thermistor.

Tiltmeter

Tiltmeters are to be installed on the abutments in quantity and at the locations as specified in the plans. The Contractor shall provide the following items as specified herein.

Provide tiltmeters, model 6350, as manufactured by Geokon Inc., model 801-W as manufactured by Roctest (not Vibrating Wire, may require separate readout box and data acquisition requirements), model TLT2 as manufactured by Geo-Instruments/ Soil Instruments LTD (not Vibrating Wire, may require separate readout box and data acquisition requirements), or acceptable equivalent.

Tiltmeters shall have documented long-term stability over a three-year period. Tiltmeters shall be the type with vibrating wire transducers, and shall be a uniaxial version with a maximum range of +/-5 degree, and shall be fitted with a thermistor.

Provide mounting bracket and hardware as recommended by manufacturer. Bracket shall conform to the requirements of Section 960, Subsection M8.05.0, and AASHTO M270, Grade 50W Mounting hardware shall be stainless steel or galvanized.

Displacement Gages

Displacement Gages are to be installed between folded plated flanges, abutment and end diaphragm, and beam and slab in quantity and at the locations as specified in the plans. The contractor shall provide the following items as specified herein:

Provide jointmeters model 4420, as manufactured by Geokon Inc., model JM-S as manufactured by Roctest, model J2-1 as manufactured by Geo-Instruments/Soil Instruments LTD, or acceptable equivalent.

Item 160.109 Cont.

Jointmeters shall have documented long-term stability over a three-year period. Jointmeters shall be the type with vibrating wire transducers with bolted anchors. The jointmeters shall have a standard range of movement of 2", 1" or ½" as required per each application and shall have built-in thermistors.

Readout Box

Two (2) handheld readout boxes (one for contractor use and one for UMass Representative) capable of taking readings on each instrument type provided in the field must be provided by the contractor. The readout box must be designed by the same commercial source as the instruments. Acceptable models include: model GK403 or GK404 as manufactured by Geokon, Inc., model MB-6T as manufactured by Roctest, model RO-1VW-3 or GI-404 as manufactured by Geo-Instruments/Soil Instruments LTD, or acceptable equivalent. The readout box must be stored in a controlled environment at the field site and be accessible to MassDOT personnel.

Signal Cables

Provide signal cable permanently attached to instrumentation by the manufacturer which shall be from the same commercial source as the insturmentation. Cable shall be as recommended by the manufacturer for each gage type, application and model. All cables must be clearly marked at each end with gage serial number and model number. The length of the cables shall be as required for connection to the Data Acquisition System.

Provide protection over all signal cables (in bundle if feasible), consisting of flexible plastic or steel conduits to the limits shown in the plans. All ends of conduit must be sealed to prevent rodent access.

Data Acquisition System

Data Acquisition System shall be designed such that all instruments with vibrating wire sensors can be remotely monitored using a telephone network via modem. The data shall be able to be read directly from the base office using an IBM compatible PC. System must also allow for direct download of data using a portable PC. Data Acquisition shall be powered by standard 110V outlet provided, provide a minimum of 2 weeks battery backup power. Solar power requirements may either power a compatible outlet, or the data acquisition system directly.

The system shall be designed by the same commercial sources as the instruments, which include: model 8021-1 micro-1000 as manufactured by Geokon, Inc., model Senslog 1000X as manufactured by Roctest, model D1 as manufactured by Geo-Instruments/Soil Instruments LTD, or acceptable equivalent. Operation shall be guaranteed for a temperature range of -5 to 125 degrees Fahrenheit.

Item 160.109 Cont.

The system shall include a vibrating wire 16-channel multiplexer and shall be capable of reading on separate channels all instrumentation as specified on the plans (96 instruments) of vibrating wire sensor data together with an equal number of channels of thermistor data. Multiplexers shall include switching hardware to be compatible with the Data Acquisition units. Multiplexer shall be designed by the same commercial source as the Data Acquisition unit, which includes: model 8032-16-1 as manufactured by Geokon, Inc., model RTX-248 as manufactured by Roctest, as manufactured by Geo-Instruments/ Soil Instruments LTD, or acceptable equivalent.

The system shall include memory to store a minimum of 75,000 individual readings and shall display readings in engineering units.

The data logger system shall have a gas discharge tube on each multiplexer channel, and earth ground connections. The data logger shall be housed either in a fully submersible sealed housing or in a sealed weatherproof NEMA 4 enclosure. The system shall be AC powered and shall be equipped with a back-up battery.

The data logger system shall include the required software to program and retrieve data from the data logger, and an interfacing network between the data logger and the PC computer. Output shall be in ASCII delineated format, and shall include gage sensor number, reading Julian day, hour and minute. The modem shall be compatible with the Data Acquisition System.

The data logger system shall be housed in the cabinet as shown in the plans and defined in Item # 812.50. The system shall be housed in a waterproof, fireproof and weatherproof control cabinets as per Item 812.50.

All signal cables shall be run to the system in conduits through junction boxes as per items 804.3 and item 811.61 and as shown on the plans.

Telephone connection and power hook-up to the system shall be as per item 813.81.

All equipment shall be adequately grounded.

Solar Power Source

A solar power source shall be provided, compatible with the requirements of the data acquisition and instrumentation system and electrical outlets (4 at 110 volts AC, 20 Watts GFI). The full system shall meet the recommendations of the instrument and data acquisition manufacturer, and be provided by the same source unless approved in writing by the Engineer and UMass. Requirements include but are not limited to a solar panel array, controller, battery and inverter with electrical outlets (4 at 110 volts AC, 20 Watts GFI) Solar panel system must be fully compatible with data acquisition system and capable of running ventilation fan in the electrical enclosure. Solar power source shall be provided in addition to electric service connection in order to set up future electrical service.

Item 160.109 Cont.

CONSTRUCTION METHODS

Pre-Installation Acceptance Tests

1. When instruments are received at the site, the Contractor's instrumentation personnel shall perform pre-installation acceptance tests to ensure that the instruments and readout units are functioning correctly prior to installation. All pre-installation acceptance tests shall be completed with the time-frame allowed by the Manufacturer for return/replacement of damaged or lost goods. Pre-installation acceptance tests shall include but not limited to the following:

    - Examine factory calibration curve and tabulated data, to verify completeness.
    - Examine manufacturer's final quality assurance inspection check list, to verify completeness.
    - Check cable length.
    - Check tag numbers on instrument and cable.
    - Check, by comparing with procurement document, that model, dimensions, and materials are correct.
    - Each electrical connector should be unmade and remade several times. While reading the instrument the cable shall be bent back and forth at point of connection to instruments to verify connection integrity. Zero readings shall agree with the reading supplied by the Manufacturer.
    - Perform resistance and insulation in accordance with criteria provided by the instrument manufacturer, using a gage insulation or circuit tester that applies 2 volts or less for resistance testing and 15 volts or less for insulation testing.
    - Verify that all components fit together in the correct configuration.
    - Check all components for signs of damage in transit.
    - Check that quantities received correspond to quantities ordered.
    - All transducers shall be connected to readout units and tilted, pressurized, squeezed, or pulled to induce changes if magnitude consistent with the calibrations supplies.

2. During pre-installation acceptance testing of each instrument the Contractor's instrumentations personnel shall complete a pre-installation acceptance test record form. Test record forms will be provided to the contractor by the Engineer on request.

3. An instrument that fails the specified pre-installation acceptance test shall be repaired such that it passes a subsequent pre-installation acceptance test, or shall be replaced by an identical instrument at no additional cost to the Department.

Item 160.109 Cont.

Installation - General

The Contractor's instrumentation personnel shall install instruments in accordance with the Contractor's detailed step-by-step procedures that were submitted and reviewed by the Engineer, according to the plans and to the specifications herein.

The Contractor shall notify the Engineer at least 72 hours prior to installing each instrument.

An instrument that fails the specified post-installation acceptance test shall be replaced by an identical instrument, if deemed feasible, at no cost to the Department.

The Contractor shall submit updated as–built instrument location plans to the Engineer and UMass. Serial number of installed gages must be clearly marked on as-built plans to document instrument field location. As each is installed, an installation record sheet shall be prepared by the Contractor.

The installation record sheet shall include, but not be limited to, a record of appropriate items from the following list:

- Project name, Contractor name and number.
- Instrument name, number, location, plan and elevation. Then location shall comprise the instrumented member and the location within the member.
- Date and time of start and completion
- Names of personnel responsible for installation and Engineer's representative.
- Results of post installation acceptance test.
- Weather conditions at time of installation.
- Comments or notes detailing any problems encountered during installation.
- Planned and as-built lengths, width, diameters, depth and volumes of backfill, grout, pipe, casing and other material used in the installation.
- Type of backfill, grout or other material used in the installation
- As built instruments in plan and elevation.
- Planned and as built orientation.

Galvanizing

Instrumentation attachments to galvanized plate material require grinding to remove galvanizing. Removal of material should be limited to the minimum area required for attachment of gages. After welding required for instrumentation the area should be repaired per recommendations of the galvanizing company used in the fabrication process. All procedures must be approved in writing by the proprietary owner of Folded Plate technology to verify that the structural integrity is not compromised.

Item 160.109 Cont.

Load Test

A load test will be conducted after final paving and prior to opening the bridge to traffic. The data acquisition system shall be fully operational and tested prior to load testing. The contractor will be responsible for coordination and costs associated with the load test. Test procedures and loading requirements shall be submitted to the Engineer for approval prior to the Live Load Test being conducted. Three fully loaded and officially weighed (certified) dump trucks will be provided by MassDOT. UMass will specify truck locations on the structure and collect data. Contractor shall provide 2 week notice prior to load testing to UMass and MassDOT. A three day window for load testing shall be provided to account for weather and scheduling conflicts.

Any cracking or other damage that occurs to the structure or roadway surface during the Load Test shall be repaired by the Contractor at no additional cost to the Department.

COMPENSATION

The work of furnishing and installing the complete instrumentation and data acquisition system will be paid for the contract lump sum price under the item which price shall include full compensation for the purchase, installation of all instrumentation and supplemental items listed herein (including connection of data acquisition and utilities), and operational checks of the instrumentation.

UMass personnel will be responsible for the monitoring of instruments and collection of data (remote and manual) following the initial reading which are to be performed by the Contractor.

For purpose of estimating partial payments for the instrumentation, the work will be separated into distinct phases as listed below and the value of each will be the assigned percentage of the lump sum bid price:

Equipment Delivered to Site.....25%
Final System Installation.....65%
Load Test Complete.....10%

Payment for final system installation shall be contingent on the proper functioning of the entire instrumentation and data acquisition system installation, including operation of services connections and accessing the Data Acquisition System remotely via the telephone and modem.

ITEM 184.1 DISPOSAL OF TREATED WOOD PRODUCTS TON

This section shall apply to the disposal of all treated wood. The timber components of the existing structure are suspected to be treated with 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.

Measurement and payment shall be by the weight, in tons, of treated timber removed from the structure and subsequently accepted at the waste-to-energy facility. The work shall be considered full compensation for all labor, tools, equipment, materials, testing, loading, transportation, approvals, and permits necessary for the completion of the work. The Contractor shall provide MassDOT with signed weight slips from the waste-to-energy facility for verification and measurement for payment purposes.

ITEM 201. CATCH BASIN EACH

The work under these items shall conform to the relevant provisions of Section 201 of the Standard Specifications and the following:

The depth of the sump for all new catch basin structures on this project will be 4 feet. The cost for the additional depth of the sump shall be included in the cost bid for the structure.

ITEM 470.2 HOT MIX ASPHALT BERM, TYPE A - MODIFIED LINEAR FOOT

Work under this item shall conform to the applicable provisions of Section 470 and the following:

Hot mix asphalt berm shall be constructed in conformance with Construction Standard drawing M/E 106.1.0R with the following exceptions:

Height of berm shall be 1”
Width of berm shall be 12”

Measurement and Payment under this item will be made at the contract bid price per linear foot of hot mix asphalt berm complete in place, which price shall constitute full compensation for all labor, tools, equipment, materials, and other incidentals necessary to complete the work.

ITEM 482.3 SAWING ASPHALT PAVEMENT LINEAR FOOT

Work under this item shall conform to the applicable provisions of Section 120, Section 460 and the following:

Work under this item shall include the sawcutting of existing asphalt pavement with power driven tools to provide a neat, clean edge for joining new pavement as shown on the plans or as directed by the Engineer. Ragged, uneven edges shall not be accepted.

Sawcuts shall be made in existing pavement at limits of full depth pavement construction, limits of resurfacing, and as directed by the Engineer. At no time will feathering of pavement to meet existing conditions be permitted. The full depth of the existing pavement shall be cut along a uniform line with an approved power driven saw.

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

Areas which have been broken or undermined shall be edged neatly with minimum disturbance to remaining pavement or sidewalks.

Pavement sawcut surfaces shall be sprayed or painted with a uniform thin coat of RS-1 asphalt emulsion immediately before placement of asphalt pavement material against the surface.

Measurement and Payment under this item will be made at the contract bid price per linear foot of sawcut completed, which price shall constitute full compensation for all labor, tools, equipment, materials, and other incidentals necessary to complete the work.

ITEM 620.1 STEEL W BEAM HIGHWAY GUARD (SINGLE FACED) FEET

Work under this item shall conform to the applicable provisions of Section 601 and the following:

Posts for highway guardrail shall be wood.

Work shall include all labor, materials and equipment to furnish and install concrete for post embedment in areas adjacent to MSE Walls as shown on the plans.

ITEM 627.8 STEEL BEAM HIGHWAY GUARD TANGENT END TREATMENT EACH

Work under this item shall conform to the applicable provisions of Section 601 and the following:

The end treatment shall meet the requirements of NCHRP 350 Test Level 2 (Design Speed less than 45 mph) for the conditions and the intended location.

ITEM 628.2 BRIDGE RAIL TO HIGHWAY GUARDRAIL TRANSITION EACH

Work under this item shall conform to the applicable provisions of Sections 501, 601 and 629 and the following:

Work shall include furnishing and installing the bridge rail to highway guardrail transition as shown in the contract documents. Transition shall include the entire length of the guardrail from the thrie beam terminal connector through W-beam to thrie beam transition, including posts, block-outs, nested beams, collapsing tube assembly, shims and all necessary hardware and work to complete installation as directed.

Work shall also include the installation of Granite Curb Type VA-5 within the limits of the transition as noted under the Method of Measurement.

METHOD OF MEASUREMENT

Bridge Rail to Highway Guardrail Transition shall be measured as units 21'-10¾" long, which shall be measured from the end of the concrete rail transition where it connects to the bridge railing to the center of the post at the limit of the W-beam to thrie beam transition.

ITEM 657. TEMPORARY FENCE FOOT

Work under this item shall include furnishing, installing, and removing a chain-link fence to be located to completely close off the construction work area. Fencing shall conform to the relevant provisions of Section 644 of the Standard Specifications.

The Contractor will be responsible for providing the Engineer with an acceptable method for the installation of the fence that will provide for the safety and security for which it is intended.

All posts including end, corner, and intermediate brace posts, and all gates and gate posts shall be included in the unit cost. The fencing height shall be 5 feet minimum. Material need not be new, but shall not be deteriorated, nor in any way jeopardize the security purposes intended. All fencing shall meet the approval of the Engineer.

Posts shall be set plumb and all fencing neatly aligned in a manner approved by the Engineer. The Contractor shall be responsible for maintenance of the temporary fence, and shall be responsible and cognizant that it remains secure and that the area is sealed off at all times to the general public. It may be necessary to move sections of temporary fence at times during construction.

Fence fabric shall be placed on the fence of the post away from the work area. A top tension wire rather than a pipe top rail shall be used. The top edge of the fabric shall be finished with a "knuckled" salvage.

Item 657. Cont.

The fence for Item 657. shall be paid at the contract unit bid price per Linear Foot and shall include all equipment, material and labor costs for a complete installation as described above.

Compensation for Item 657. shall also include the replacement and/or restoration of fence damaged due to construction accidents, vandalism and/or any other manner. Removal of the fence shall be included under Item 657. and the fence shall not be removed until the work is complete or the area is secured by other means acceptable to the Engineer.

ITEM 698.4 GEOTEXTILE FABRIC FOR PERMANENT EROSION CONTROL SQUARE YARD

The work under this item shall include the installation of geotextile fabric for permanent erosion control underneath the proposed riprap as shown on the contract plans.

MATERIALS

Geotextile Fabric for Permanent Erosion Control shall conform to the provisions of Section M9.50.0. Geotextile fabric shall conform to the requirements of AASHTO M 288 for the intended use. The physical requirements of the geotextile fabric shall conform to those shown in Table II of Section M9.50.0.

COMPENSATION

The work will be paid for at the contract unit price per square yard, installed complete in place, including all labor, materials and equipment required or incidental for the satisfactory completion of the work.

ITEM 740. ENGINEER'S FIELD OFFICE AND EQUIPMENT (TYPE A) MONTH

Work under this item shall conform to the relevant provisions of Section 740 of the Standard Specifications and the following:

A computer system and digital camera meeting the requirements set forth below and including installation, maintenance, and removal shall be provided at the Resident Engineer's Office. The diskettes (3-1/2" and Zip) shall become the property of the Massachusetts Highway Department.

The computer system shall consist of the following minimum requirements:

Computer:	DELL, Compaq, or IBM,
CPU:	Intel Pentium IV, AMD Athlon, 2.0 GHz or better
RAM:	1 Gb of PC2100DDR SD RAM or better

Item 740. Cont.

Video:	Integrated AGP video with 16MB of RAM (dedicated or shared is acceptable)
Hard disk:	100GB, 7200RPM, ATA-100 or better
Monitor:	19" LCD, TFT Height adjustable stand, 1280x1024 pixel pitch DVI, 24pin DVI Flat Panel, meeting EPA Energy Star Conservation Standard
CD-RW:	CDRW, 40X speed and 10 CD-R diskettes
Modem:	56K/V.90 internal or external modem
Floppy:	Standard 3.5" 1.44MB floppy disk drive and 10 - 1.44Mb Diskettes
Mouse:	Microsoft Intellimouse or equivalent
Keyboard:	Standard 104-key
Printer:	HP 1200 LaserJet printer with bi-directional printer cable
OS:	Windows XP (latest edition)
Office:	Microsoft Office XP Professional (latest edition) Photo editing software for digital photos
Digital Camera:	Sony Mavica Model #MVC-FD73, or equivalent with following minimum specifications:
Lens:	f+4.2-42 mm (40-400 mm, when converted into a 35 mm still camera F1.8.2.9
Exposure Control:	Automatic Exposure
White Balance:	Automatic
Data Compression:	Standard JPEG
Memory:	Floppy Disk: 3.5 inch 2HD MS-DOS format (1.44MB)
LCD Panel:	2.5 inch
General:	2-battery packs and charger Camera bag with shoulder straps Floppy discs (10 per month) Photo print paper (50 sheets/month)

Item 740. Cont.

Except as noted above, the Engineer's Field Office and equipment included therein, including the computer system, shall remain the property of the Contractor at the completion of the project.

ITEM 755. WETLAND REPLICATION AREA SQUARE YARD

The work to be done under this section includes excavating, fine grading, and installing wetland soil and plants where shown on plans and as directed by the Engineer.

Contractor shall be responsible to retain an Environmental Scientist (e.g., Botanist, Biologist, Wetland Scientist, or other individual with similar qualifications) and a minimum of two years experience in similar wetlands replacements. The Environmental Scientist shall perform survey of work areas and materials to be rehandled and spread. Also, the Environmental Scientist shall perform survey of site conditions as required by the Conservation Commission, "Order of Conditions" and as directed by Engineer.

CONSTRUCTION METHODS

General

The contractor shall plan and execute operations in a manner minimizing the amount of excavated and exposed fill, or other foreign materials that are washed or otherwise carried into the wetland resource areas.

Erosion and Sedimentation Control

A single row of staked haybales and sedimentation fence shall be installed along the border of the existing wetland and the limit of wetland fill as shown on the plans. Haybales shall be tightly butted to the adjacent bales, and staked with two 1-inch x 1-inch x 3-feet stakes spaced evenly in the bale and driven solidly into the underlying material. This shall serve as the limit of work line. Following planting, a second line of staked hay bales and sedimentation fence shall be placed at the upper limit of the wetland replacement area, as shown on the plans. These will serve to protect the replacement area from sedimentation and from foreign materials that could potentially enter the area.

Replacement Area Preparation

This wetland replacement shall be performed under the direction and guidance of a qualified Environmental Scientist and as specified in these provisions. The preparation of the replacement area shall be accomplished in the following order. The replacement area shall be excavated beginning at the edge of wetlands to be extended. The excavation at this location shall be a minimum depth of 12-inches below the adjacent wetland grade to be adjoined. The bottom of the excavation shall be graded to be 12- inches below the adjacent wetlands minimum. The location of the replacement area is shown on the plan. Additional depth to remove material below this bottom grade may be required, with the additional excavated material to be replaced with hydric soil.

Item 755. Cont.

Any wetland resource area adjacent to the replacement area shall be separated from the replacement area by a barrier of haybales and silt fence as shown on the drawings. Excavated soil shall become the property of the Contractor to be legally disposed of off- site or recycled for use or as directed by the Engineer.

All trees, stumps, and brush and other vegetation shall be removed from the wetland area that is to be affected by the project and shall become the property of the Contractor to be legally disposed of off site or recycled for use.

No excavated or waste material shall be stockpiled in the resource areas or buffer zone while awaiting disposal.

Wetland Soils

Usable hydric soil from the proposed wetland fill areas shall be excavated, rehandled and spread in the replacement area. There shall be a 12-inch minimum deep layer of hydric soils placed in the replacement area. If there is not sufficient usable hydric soil in the proposed wetland fill areas to provide 12-inches of backfill in the wetland replacement area, an alternative soil mixture may be used. This shall consist of plantable soil borrow and shall have at least 20% organic matter by volume. Peat moss of any type shall not be used as a sourc-e of organic matter.

All excavated soils must be stockpiled outside the resource area and at least 100 feet from the edge of the wetland. Precautions (e.g., temporary covering of stockpiles, haybale barriers around stockpiles) shall be taken as necessary to prevent erosion of the stockpiled material.

Finished grade shall be at an elevation that provides a hydrologic connection between the replacement area and the adjacent wetland. The Contractor shall verify that this elevation is not at a level that could dewater an adjacent wetland.

The wetland soils shall be deposited in the replacement area in a manner minimizing travel over and subsequent compaction of the underlying material and replacement wetland soils.

Upon completion of the replacement area, a haybale barrier shall be placed around the entire perimeter to protect it during the rest of the construction.

The final grading of the wetland soils shall result in no breaks in elevation upon removal of sedimentation barriers.

The sedimentation barriers shall be removed at the completion of all construction for the project. The ground under the sedimentation barriers shall be reseeded when the barriers are removed.

Item 755. Cont.

Wetland Replacement Planting

The intent of this Section is to insure that at least 75 percent replacement surface area is reestablished with indigenous wetland plant species within two growing seasons of their planting in accordance with the Massachusetts DEP Wetlands Protection Act Regulations. The following specifications provide for good establishment, low transplant shock, monitoring of the plantings, and replacement of plant material if necessary.

Planting Specifications

After the replacement area has been prepared as described above, it shall be planted. Wetland planting shall be performed between April 1 and June 15 or September 1 and October 30 or as recommended by the Environmental Scientist and as approved by the Engineer. Specific guidance for planting materials is as follows:

All plant material used shall be nursery grown and healthy, sound and free of disease, insect, pests, eggs or larvae, and shall have a well-developed root system. Container-grown plants shall have sufficient roots to hold planting mix intact after removal from containers, but should not be root-bound.

Plant material shall be planted as soon as possible (within one week) after it has been purchased. All plant materials temporarily stored at the site prior to planting shall be maintained by careful watering, and shall be protected from damage by construction activities and adverse weather conditions

The plantings shall consist of the materials specified on the attached drawings. It may be necessary to substitute approved alternative plants if the specified plant material is not available. Any substitutions must-be approved by the Wetland Scientist prior to planting.

Planting Procedure

All wetland plantings shall be performed by hand, using hand implements, e.g., shovel or trowel. The following procedure shall be used for wetland plantings.

Plants shall be placed as specified in the project drawings and as directed by Wetland Scientist. To install each plant, a small hole shall be dug. A mixture of water and soil from the hole shall be prepared. The plant shall be removed from its container or burlap covering and set in the hole in a manner so that the top of the root ball is level with the surface of the ground. Care should be taken to keep the root ball intact while handling.

Item 755. Cont.

For Balled & Burlap and container-grown material only, the following procedure for fertilizer application applies. Once each hole is dug for the replacement area vegetation, a small portion of slow release, root contact type fertilizer should be placed in the hole prior to the input of the plant material. Any fertilizer used for this work first must be approved by the Wetland Scientist at least by one week prior to use. For all shrub material, a small portion of bone meal shall also be placed into the hole prior to insertion of the shrub. All vegetation shall be fertilized with a fertilizer that is high in phosphorus composition to aid in plant root development. Care shall be taken to not over-fertilize the transplanted plant material. If, by the determination of the Wetland Scientist, some plants are burned due to over-application of the fertilizer, all affected plant material shall be replaced in-kind immediately by the horticultural contractor. For bare-root material, no fertilizer shall be placed in the hole at time of planting.

After fertilizer has been added and the plants placed, the soil mixture shall be backfilled into the hole and lightly compacted around the base of the plant.

After plantings are completed, the replacement area will be hand raked to eliminate all soil compaction. Hand raking shall be conducted until soil is loose. Raking will also be performed in order to maintain finish grades established prior to planting. It is essential that any planted material be watered after planting within the same day. If for any reason all plantings are not accomplished in one day, the finished plantings must be watered in the interim.

Wetland seed mix shall be applied after soil has been raked. A native wetland diversity seed mixture shall be sown throughout the wetland replication area. The seed mix shall be the 2004 wetmix available from New England Wetland Plants, 820 West Street, Amherst, MA or equal approved by the Environmental Scientist. Seed shall be sown by hand or by a small mechanical lawn seeder at the rates specified by the supplier and approved by the Environmental Scientist. Water-soluble, quick-release fertilizer shall be broadcast at recommended rates along with the seed mix. The fertilizer nutrient analysis (ratio of sources of Nitrogen: Phosphorous: Potassium) should not be higher than 10-10-10. Watering of the seeded area must take place after seeding within that same day. Care should be taken during watering to direct a gentle spray of water that does not disturb seed on the soil surface.

Monitoring and Replacement
Monitoring will be performed in order to ensure satisfactory plant establishment and compliance with the performance standards for Bordering Vegetated Wetland from the Massachusetts Wetlands Protection Act Regulations at 310 CMR 10.55 (4)(b) or with any other relevant regulations of the Department of Environmental Protection.

Item 755. Cont.

First Inspection
An inspection shall be conducted at the end of the first full growing season, or 180 growing season days after planting, whichever comes first. Following this inspection, the Contractor is required to replace all plants that have not shown satisfactory evidence of establishment, and to reseed any areas that have not achieved at least 50 percent cover with wetland herbaceous species. Cover shall be generally uniform over the entire planted area. 50 percent healthy foliage shall be assumed satisfactory evidence of growth after the first growing season. In any area where this coverage by healthy vegetation has not been achieved, all dead or unsatisfactory plants shall be removed and replaced in kind and size by the contractor, at no additional cost to the owner, with plants as originally established under this specification and planting plan.

Second Inspection
A second inspection shall be made at the end of the second growing season. Following this inspection, the Contractor is required to replace all plants that are not healthy or are not flourishing. At the time of the second inspection, the Wetland Scientist shall determine whether the wetland replacement area has achieved the required 75 percent uniform coverage of re-vegetation with wetland plant species. 75 percent uniform cover by wetland species shall be assumed satisfactory evidence of growth after the second growing season. If this percentage is not achieved, additional plantings of the specified kind and rate, shall be made by the contractor, at no additional cost to the owner.

METHOD OF MEASUREMENT

Wetland replacement area shall be measured per the square yard of wetland replication completed.

BASIS OF PAYMENT

Wetland replacement area shall be paid for by the unit bid price per square yard of wetland replication completed. This cost shall be full compensation for retaining a Wetland Scientist, survey of areas regarding existing conditions, evaluation of presence of satisfactory existing wetland (hydric) soils for reuse in the replication area, excavation, provision and placement of suitable wetland soil materials, grading, and protection of the work. The cost shall also be full compensation for wetland plantings, seeding, fertilizer, watering, inspections and all incidental costs for the satisfactory establishment of the wetland replication area.

Partial payments will be made upon satisfactory completion of the following activities at the noted percentages of the unit bid price:

Establishment of Wetland Replication Area.....90%
Second Inspection and Acceptance of Required Coverage Goals.....10%

Payment for installation and maintenance of hay bales and sedimentation fence will be under Items 767.8 and 697., respectively.

ITEM 755.1 WETLAND RESTORATION AREA SQUARE YARD

It shall be the responsibility of the Contractor to retain a Botanist, Biologist, Wetland Scientist, or other individual with similar qualifications and a minimum of two years experience in similar wetlands replacements, and thoroughly versed in the Commonwealth of Massachusetts Wetland Protection Act (MGL C.131, s.40), it Regulations (310 CMR 10.00) and all other relevant regulations of the Department of Environmental Protection. This individual, herein after referred to as "Botanist", shall be approved by the Resident Engineer.

The restored wetland area will take advantage of the natural wetland soils found in this location. These soils can be preserved by either covering them with geotextile prior to the construction of the retaining wall or by removing these soils, stockpiling them while the retaining wall is being constructed and reinstalling them to the approximate original grade of the natural wetland when the wetland restoration area is being constructed.

A single row of staked haybales and sedimentation fence shall be installed along the border of the existing wetland and the limit of wetland disturbance as shown on the plans. Haybales shall be tightly abutted to the adjacent bales, and staked with two 1" x 2" x 3' stakes spaced evenly in the bale and driven solidly into the underlying material. This shall serve as the limit of work line. Following planting, a second line of staked haybales and sedimentation fence shall be placed at the upper limit of the wetland restoration area. These will serve to protect the restoration area from sedimentation and from foreign materials which could potentially enter the area.

Within the restoration area, if the soils have been covered with geotextile in the vicinity of the retaining wall, then they should be loosened so as to reduce soil compaction in the area. If the soils were removed, then they should be replaced at and elevations similar to the elevation of the ground surface prior to disturbance. A native wetland diversity seed mixture shall be sown throughout the wetland restoration area. The wetland seed mix will be broadcast by hand or mechanical spreader or hydro seeded, at a rate of 1 lb/5,000 square feet. The seed mix shall be lightly raked in the soil immediately after broadcasting.

After the restoration area has been prepared as described above, it shall be planted. Wetland plantings shall be performed between April 15 and October 15 or as recommended by the Botanist and as approved by the Engineer. Specific guidance for planting materials is as follows:

1. All plant material used shall be nursery grown and healthy, sound and free of disease, insect, pests, eggs or larvae, and shall have a well-developed root system. Container-grown plants shall have sufficient roots to hold planting mix intact after removal from containers, but should not be root-bound.
2. Plant material shall be planted as soon as possible (within one week) after it has been purchased. If it sits at the site before being planted, it shall be maintained by careful watering.

Item 755.1 Cont.

3. The planting will consist of the material specified on the contract plans. It may be necessary to substitute if the specified plant material is not available. Any substitutions must be approved by the Botanist prior to planting.

Monitoring and Replacement

Monitoring will be performed in order to ensure satisfactory plant establishment and compliance with the performance standards for Bordering Vegetated Wetland from the Massachusetts Wetlands Protection Act Regulations at 310 CMR 10.55(4)(b) or with any other relevant regulations of the Department of Environmental Protection.

First Inspection

An inspection shall be conducted at the end of the first full growing season, or 180 growing season days after planting, whichever comes first. Following inspection, the Contractor is required to replace all plants that have not shown satisfactory evidence of establishment, and to reseed any areas that have not achieved at least 50 percent cover with wetland herbaceous species. 50 percent healthy foliage shall be assumed satisfactory evidence of growth after the first growing season. All dead or unsatisfactory plants shall be removed and replaced in kind and size by the Contractor, at no additional cost to the State, with plants as originally established under this specification and planting plan.

Second Inspection

A second inspection shall be made at the end of the second growing season. Following this inspection, the Contractor is required to replace all planst that are not healthy or are not flourishing. At the time of the second inspection, the Botanist shall determine whether the wetland replacement area has achieved the required 75 percent re-vegetation with wetland plant species. 75 percent cover by wetland species shall be assumed satisfactory evidence of growth after the second growing season. If this percentage is not achieved additional plantings, of the specified kind and rate, must be made by the Contractor, at no additional cost to the State.

METHOD OF MEASUREMENT

Wetland restoration area shall be measured per the square yard of wetland restoration completed.

BASIS OF PAYMENT

Wetland restoration area shall be paid for by the unit bid price per square yard of wetland restoration completed. This cost shall be full compensation for retaining a Botanist, placement of wetland soils within the restoration area, stockpiling and covering of existing wetland soil materials, grading, and protection of work. The cost shall also be full compensation for wetland plantings, seeding, fertilizer, watering, inspections and all incidental costs for the satisfactory establishment of the wetland restoration area.

Item 755.1 Cont.

Removal of wetland soils to the depths indicated on the plans, to include the limits of topsoil stripping, will be included under the appropriate item for Earth Excavation or Mechanically Stabilized Earth Walls. Any excavation of wetland materials beyond these limits will be included in the price bid for Item 755.1.

Partial payments will be made upon satisfactory completion of the following activities at the noted percentages of the unit bid price:

Establishment of Wetland Restoration Area.....90%
Second Inspection and Acceptance of Required Coverage Goals.....10%

Payment for installation and maintenance of hay bales and sedimentation fence will be under Items 767.8 and 697., respectively.

ITEM 765. SEEDING SQUARE YARD

The work under this item shall conform to the relevant provisions of Section 765 of the Standard Specifications and the following:

Grass seeding in roadside areas to be constructed as shown on the plans, other than wetland restoration and wetland replication areas, shall conform to the following Roadside Seed Mix table:

	Percent Proportion	Percent Germination Minimum	Percent Purity Minimum
Hard Fescue (Festuca Ovina)	25%	85%	95%
Chewings Fescue (Festuca Rubra 'Commutata'	25%	85%	90%
Salty Alkai Grass (Puccinella Spp.)	50%	85%	95%

Roadside Seed Mix shall be applied at a rate of 200 lbs/acre.

ITEM 767.9 MATTING FOR EROSION CONTROL SQUARE YARD

The work under this item shall conform to the relevant provisions of Section 767 of the standard specifications and the following:

MATERIALS

Matting for Erosion Control shall be machine-produced 100% biodegradable fabric with 70% agricultural straw and 30% coconut fiber lend matrix.

Item 767.9 Cont.

The fabric shall be of consistent thickness with the straw and coconut fiber evenly distributed over the entire area of the fabric. The mat shall be covered on the top and bottom sides with 100% biodegradable natural organic fiber netting, woven into an approximate ½" x 1" mesh. The mat shall be sewn with biodegradable thread on 1½" centers.

Straw/Coconut fiber erosion control mat shall have the following properties:

Materials:

Matrix 70% straw fiber (0.35 lb. /sq. yd)
30% coconut fiber (0.15 lb. /sq. yd)
Netting both sides woven 100% biodegradable natural organic fiber (9.3 lbs. /1, 00 sq. ft. approx. weight).
100% Biodegradable thread.

Physical Specifications (Roll)

Width:	5.83 feet +/- 5%
Length:	90.3 feet +/- 5%
Weight:	40 lbs. +/- 10%
Area:	60 sq. yd.

CONSTRUCTION METHODS

Refer to staple guide, supplied by the manufacturer, for correct staple pattern recommendations for slope installations.

1. Prepare soil before installing mats, including application of lime, fertilizer, and seed.

2. Begin at the top of the slope by anchoring the mat in a 6 inch deep by 6 inch wide trench. Backfill and compact the trench after stapling.

3. Roll the mats (A.) down or (B.) horizontally across the slope.

4. The edges of parallel mats must be stapled with approximately 2 inch of overlap.

5. When mats must be spliced down the slope, place mats end over end (shingle style) with approximately 4 inches of overlap. Staple through overlapped area, approximately 6 inches apart.

Item 767.9 Cont.

COMPENSATION

The work will be paid for at the contract unit price per square yard, installed complete in place, including all labor, materials and equipment required or incidental for the satisfactory completion of the work.

ITEM 769.1 PAVEMENT MILLING MULCH UNDER GUARD RAIL SQUARE YARD

Work under this item shall conform to the applicable provisions of Section 769 of the Standard Specifications and the following:

The quantity of pavement milling mulch shall be the number of square yards based on actual measurements made over the surface area of the pavement milling mulch.

The work under this item shall be paid for at the contract unit price per square yard complete in place, which price shall include the geotextile fabric, pavement millings, and all related excavation, borrow, and grading.

ITEM 812.50 CONTROL CABINET AND FOUNDATION EACH

DESCRIPTION

This item shall consist of furnishing and installing a control cabinet at the location shown on the plans, or as ordered, and in accordance with these specifications. Included in this work, where called for, is control cabinet with electrical and telephone components, service entrance conductors and conduits, foundation, transformer pad, metering provisions and utility work.

MATERIALS

The materials for this work shall conform, as applicable, to the requirements of Section 801and Section 815 of the Standard Specifications.

CONSTRUCTION METHODS

All work shall be constructed as shown on the plans or as required by the utility company or the Instrumentation Engineer and as directed by the Engineer.

The Contractor shall give adequate notice to utility companies for scheduling of work by utility.

Item 812.50 Cont.

The concrete pad and concrete foundation shall be constructed in conformance with Article 801.62 and Section 901 "Cement Concrete Masonry", and as applicable. The concrete pad shall be in conformance with the MassDOT "Standard Drawings for Traffic Signals and Highway Lighting", Dwg. SD3-050, or as approved by the Engineer. Conduits, inserts, sleeves and fittings shall be placed in proper position and shall be secured until the concrete sets.

The cabinet shall be constructed to the dimensions as required to contain the Data Acquisition System and utility service equipment, as directed by the Instrumentation Engineer and as approved by the Engineer in conformance with Section 815, as applicable. Plans of the cabinet, including equipment layout, shall be prepared by the Contractor and submitted for review in accordance with Subsection 5.02 of the Standard Specifications.

The cabinet shall be fabricated from 5052-H32 sheet aluminum alloy at least 0.125 of an inch thick and adequately reinforced. It shall be of all-weather construction.

The cabinet shall be capable of housing the Data Acquisition System, and all other necessary auxiliary equipment and terminal facilities and shall conform to the following electrical and mechanical requirements:

The cabinet shall have a main door equipped with a keyed tumbler lock of the type in current use by the Department. Two keys shall be furnished with the lock. Door hinge pins shall be made from stainless steel.

A main power switch shall be provided inside the cabinet.

The cabinet shall be equipped with a thermostatically controlled fan and filtered vents, raintight.

The cabinet shall be fitted with as many as required shelves or brackets to support the Data Acquisition System units and all other auxiliary equipment.

A solid neutral circuit breaker panel for power service shall be mounted in the cabinet.

Thermostat controlled fan unit (to keep under 12ºF) and thermostat controlled light socket fitted with outdoor light bulb (to keep above -5ºF).

A convenience outlet standard 3-wire grounding duplex receptacle, 20 Amp capacity with integral ground fault interrupter shall be mounted in the cabinet.

An incandescent light, with switch shall be installed in the cabinet.

All surfaces of the cabinet and doors shall be painted a minimum of two (2) coats of aluminum paint, excluding primer.

Item 812.50 Cont.

COMPENSATION

The accepted quantity of this item "Control Cabinet and Foundation" shall be measured for payment per each and shall be paid at the contract bid unit price for each complete in place. All additional materials and labor required to complete the above item as specified shall be considered as incidental to the construction and shall be included in the contract unit price bid.

Payment for work associated with conduit installation and service connections will be paid separately under their respective items.

ITEM 813.81 SERVICE CONNECTION LUMP SUM

Work under this item shall conform to the relevant provisions of section 813 of the standard specifications and the following:

DESCRIPTION

The work for this item shall consist of furnishing power and telephone service to the service cabinet (housing the Data Acquisition System) from utility company lines. The service shall be capable of providing 110 volts, 60 hertz voltage to the service cabinets and a single telephone line to be connected to a modem in the cabinet. The contractor shall determine exact locations and riser elevations from the serving utility and arrange to complete the service connection. The Department shall be responsible for utility company charges associated with maintaining service following acceptance of the Data Acquisition System by the Department.

It is anticipated that the permanent service poles will not be in place prior to the initiation of the required service. The Contractor shall be responsible for providing temporary power and telephone service until such time that the permanent service can be completed.

The Contractor shall be responsible for coordinating his work with the appropriate utility companies.

MATERIALS

All materials for this item shall conform to Section 801 and Section 813, as applicable, and as required by the utility and as shown on the plans.

Item 813.81 Cont.

CONSTRUCTION METHODS

The Contractor shall notify the utility of the construction schedule to coordinate the installation of the electric and telephone lines including temporary services connections, as necessary. The permanent telephone and electric cables shall be run underground from the service points to the service cabinets; temporary services lines, if required, may be run either above ground or underground provided they are adequately protected and pending the approval of the utility provider and the Engineer. Telephone and electric cables shall be run inside separate conduits and in accordance to section 801, as applicable. The installation of cables and wires shall conform to section 813, as applicable.

COMPENSATION

The accepted quantity of this item "Service Connection" shall be measured for payment as a unit and shall be paid for at the contract bid lump sum price complete in place. All additional materials and labor required to complete all of the above items as specified, including any required temporary service, shall be considered as incidental to the construction and shall be included in the lump sum price bid.

ITEM 850.41 ROADWAY TRAFFIC FLAGGERS HOUR

The Contractor shall provide the number of flaggers required as shown on the contract plans or as directed by the Engineer for the direction and control of traffic within the project site. A flagger shall be used as directed by the Engineer in accordance with 701CMR 7.00, this section, and the Traffic Control Plans. Any flagger determined by the Engineer to be ineffective in controlling traffic may be removed at the discretion of the Engineer. If a flagger is directed to be removed, the Contractor shall immediately comply with the directive from the Engineer and shall suspend operations as necessary until a qualified replacement can be provided. Such a suspension of operations shall not be considered as a basis for a claim or an extension of time.

Flaggers used during the performance of the work shall be at least eighteen years of age.

Flaggers used during the performance of the work shall possess a current certificate of satisfactory completion from the Department-approved flagger training program within the previous two (2) years. Prior to the start of work, the Contractor shall provide to the Engineer a written list of certified flaggers to be used, including the most recent date of certification or re-certification for each person listed. All flaggers shall carry their approved flagging training program certification card with them while performing flagging duties. Flagger certifications shall remain valid for the duration of the project or the flagger shall be removed from the project.

Item 850.41 Cont.

Flaggers used during the performance of the Work shall have completed a First Aid training course according to the standards and guidelines of the American Heart Association or the American Red Cross. Flaggers shall carry their First Aid certification cards with them while performing flagging duties. First Aid certifications need not be renewed once the initial certification has expired.

Each flagger shall be equipped with the following high visibility clothing, signaling, and safety devices:

(1) A white protective hard hat with a minimum level of reflectivity per the requirements of ANSI, Type I, Class E&G;

(2) A clean, unfaded, untorn lime/yellow reflective safety vest and safety pants meeting the requirements of ANSI 107 Class 3;

(3) A twenty-four inch "STOP/SLOW" traffic paddle conforming to the requirements of Part 6E.03 of the Manual of Uniform Traffic Control Devices (MUTCD), a weighted, reflectorized red flag, flagger station advance warning signage, and two-way radios capable of providing clear communication within the work zone between flaggers, the Contractor, and the Engineer. The traffic paddle shall be mounted on a pole of sufficient length to be seven feet above the ground as measured from the bottom of the paddle;

(4) A working flashlight with a minimum of 15,000 candlepower and a six inch red attachable wand, a whistle with an attached lanyard, and a First Aid kit that complies with the requirements of ANSI Z308.1;

(5) An industrial/safety type portable air horn that complies with the requirements of the U.S. Coast Guard.

BASIS OF PAYMENT

Compensation for flaggers will be paid on an hourly basis for only the actual time spent flagging and payment will be made under Item 850.41, Roadway Flagger. No allowance or additional payment will be made for required training, equipment, travel time, transportation, or any administrative charges associated with the cost of the flaggers.

ITEM 874.4 TRAFFIC SIGN REMOVED AND STACKED EACH

Work to be done under this item shall include the dismantling, removal, transporting and stacking of all existing warning, regulatory and route marker signs and their supports.

Also included is the excavation of the existing foundations to a depth of at least 6 inches below the ground level, backfilling with compacted gravel and the restoration or replacement in kind of the holes resulting from the excavation. The sign panels and supports shall be stacked on boards at a location selected by the Engineer. The existing signs shall not be removed until the new signs and structures replacing them are ready for traffic or until the Engineer shall permit.

If the Engineer determines that any part of the stacked material is unsuitable for reuse, said materials shall become the property of the Contractor, and he shall dispose of them away from the site.

Work to be done under this item shall be paid for at the contract unit bid price per Each, which price will be full compensation for dismantling, loading, transporting and stacking of the signs and their supports as designated above, the excavation of the existing restoration, or replacement in kind where foundations and parts are removed.

ITEM 942.124 STEEL PILE HP 12 X 84 EACH

The work under this item shall conform to the relevant provisions of Section 940, Driven Piles, of the Standards except as modified herein.

MATERIAL

The piles shall conform to the requirements of AASHTO M270 Grade 50.

The pile size shall be HP12x84. No substitution of pile size shall be permitted.

SUBMISSIONS

Prior to any pile installation operations, the Contractor shall submit for the review and approval of the Engineer a schedule of the proposed methods and equipment for all related installation procedures. At the integral abutments, the Contractor shall include in his/her submittal under this Item all pertinent details of the necessary procedures to pre-auger and maintain the diameter of the holes and to fill the holes with Crushed Stone after installing.

Bridge piles shall be placed and concreted within approved bedrock sockets. No pile: Wave Equation Analyses, dynamic testing or static load testing will be required.

At the integral abutments, the Contractor's attention is directed to the required sequence of pre-augering 30 inch diameter holes to a depth as shown on the plans below the bottom of the pile cap, installing the foundation piles for each portion of the Integral Abutments being constructed, and filling the holes with Crushed Stone under Item 156.13.

Item 942.124 Cont.

Pile Splices

Due to the location of bedrock as identified on the boring logs of the plans, it is anticipated that splicing will not be required. If the lengths of piles require splices, the splicing shall conform to applicable Standard Specification Subsection 940.66.

No splices shall be permitted within the top 25 feet of any pile. Splices are permitted if the splice location occurs more than 25 feet from the bottom of the abutment wall. Welds shall be inspected using ultrasonic testing in accordance with the Bridge Welding Code, ANSI/AASHTO/AWS D1.5. Welds shall be considered to be in tension.

The Contractor shall submit shop drawings showing the type of prequalified splice weld(s) and procedures that would be used if required, regardless of whether or not the Contractor anticipates splices to be used. Prequalified weld and procedures shall conform to the Bridge Welding Code, ANSI/AASHTO/AWS D1.5 and all Interim Revisions published by AASHTO as of bid opening date.

Obstructions

The Contractor is advised of the potential existence of natural and man-made obstructions (boulders, granite and concrete foundations, etc.) within the soil overburden above the bedrock surface at this site. Class B Rock Excavation shall be performed as needed to remove existing stone rubble and/or masonry foundation elements that obstruct the proposed work above the level of the bottom of the proposed foundations. Pre-Drilling for Piles (Item 944.2) shall be used as needed to drill through obstructions. At the integral abutments, after the required earthwork operations have been satisfactorily completed and prior to installing each pile, a 30 inch diameter hole shall be carefully pre-augered through the existing in-situ embankment materials below the bottom of the abutment wall as shown on the Plans.

CONSTRUCTION

The procedure for installing piles shall conform to Subsection 940.65 of Standard Specifications.

At the integral abutments the accuracy of installing shall be superseded by the following:

A. Prior to installing any pile, the Contractor shall set up appropriate templates to locate each pile to within 1 inch of its location as shown on the Plans. The pile shall be surveyed after being set in the template to verify that it is plumb. During installing, each pile shall be monitored toverify that it remains plumb and within location tolerance. The installing shall be stopped at appropriate intervals in order to check the proper axial alignment and location of the pile. Installing shall not be resumed without the approval of the Engineer. Pulling laterally on piles and/or heat treating of piles to correct misalignment shall not be allowed. Each pile shall be installed so that its horizontal alignment at cutoff elevation is within the tolerances shown on the Plans.

Item 942.124 Cont.

B. If any pile after installing is beyond the specified tolerances shown on the Plans, the Contractor shall extract the misaligned pile in its entirety, and shall install a replacement pile to satisfy the tolerances specified in these Special Provisions. All of such corrective work shall be done without extra compensation for that pile which is being pulled. Pulling laterally on piles and/or heat treating of piles to correct misalignment shall not be allowed. After each pile is in place, the Engineer will inspect the pile for any damage due to installing such as twisting, buckling, and loss of section. If such damage exists, in the judgment of the Engineer, the pile shall be removed and replaced in its entirety without additional compensation.

The Contractor shall keep a record, independent of any which may be made by the Engineer, of all pertinent field data relative to the installation of each pile. This record shall be available for the Engineer's inspection, being transmitted to him/her as he/she may direct. As a minimum, this record shall include for each pile:

1. Date and time of installation;
2. Kind and size of hammer, the pressure and speed at which operated;
3. Total penetration to the closest 2 inches, shown by point elevation and cutoff elevation;
4. Blows for the entire pile depth and blows per the last 4 inches of penetration;
5. Pertinent notes as to any unusual behavior of a pile.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The method of measurement and basis of payment will be based upon the relevant provisions of Section 940. The contract unit price shall be considered full compensation for all labor and materials required, including, but not limited to, making and maintaining the pre-augured holes at the integral abutments, splicing and welding, and keeping pile installing records.

Class B Rock Excavation shall be paid for under Item 144. Separate payment shall be made under Item 156.13 for all Crushed Stone placed within pre-augured holes. Pre-Drilling for Piles shall be paid for under Item 944.2.

ITEM 944.2 PRE-DRILLING FOR PILES FOOT

The work under this Item shall conform to the relevant provisions of Sections 940, 150, and the following:

Obstructions

The Contractor is advised of the potential existence of natural obstructions (boulders, granite, etc.) at this site. Pre-Drilling for Piles shall be used as needed to drill through obstructions. The primary purpose of such obstruction removal is to allow piles to be installed without damage and within alignment tolerances. Drilling will be permitted only to the depths indicated on the Plans or otherwise approved by the Engineer in writing.

Item 944.2 Cont.

Submissions

The Contractor shall include in his/her submittal under this Item all pertinent details of the necessary procedures for drilling the holes, removing obstructions, maintaining the diameter of the holes, and filling the holes with sand borrow after installation.

CONSTRUCTION

The Contractor shall insure that each hole is drilled vertically within the horizontal tolerances specified in Subsection 940.65. The specified diameter of the hole is to be continuously maintained for the full depth, regardless of the characteristics of the materials being penetrated. If required by field conditions or directed by the Engineer, the Contractor shall simultaneously install at each hole temporary steel casing to the bottom of the drilled hole having the required strength and size to maintain the specified diameter and location of each hole. Unless specifically authorized in writing by the Engineer, the Contractor shall carefully extract the full length of each temporary steel casing while the hole is simultaneously being filled with sand borrow without allowing the penetrated soil materials to collapse into, or otherwise reduce the specified diameter of the hole.

After installing the foundation piles, crushed stone conforming to M2.01.6 shall be placed within each drilled hole below the bottom of the proposed abutments as shown on the plans.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement will be made along the centerline of each pre-drilled hole from the top to the bottom of the obstruction or otherwise approved by the Engineer. Measurement will not be made for drilling holes above the bottom of the existing masonry foundation without the written approval of the Engineer prior to such drilling.

Payment for all work included and specified under Item 944.2, Pre-Drilling for Piles, will be paid at the Contract unit price per foot. This price shall be considered full compensation for furnishing and operating equipment, providing materials and labor necessary to drill through and/or remove the obstruction(s), to supply and place the sand borrow backfill, and to provide the specified clearance necessary for installing the pile within the specified tolerance and without damage. This price shall also include the cost of extraction of each obstructed pile and re-installing of the pile to the top level of obstruction. The cost for furnishing and installing the steel piles will be paid under Item 942.124, Steel Pile HP 12 X 84. Crushed Stone shall be measured and paid for under Item 156.13 Crushed Stone for Integral Abutment Piles.

ITEM 944.3 DRILLED ROCK SOCKET FOR PILES FOOT

The work under this Item shall conform to the relevant provisions of Sections 945 and the following:

CONSTRUCTION

Work shall include coring through rock as indicated in the plans as necessary to achieve the designated pile tip elevations as shown on the Drawings or as directed by the Engineer for steel H-pile installation. Work shall also include coring bedrock socket and encasing the pile in the rock socket with 5000 psi, ¾", 705 cement concrete to the depth as shown on the Plans.

Rock cores shall be 30 inches in diameter, a minimum of 5'-0" deep, and shall be plumb.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and payment under this Item shall be at the contract unit price per foot of vertical holes cored through rock. Such price shall be considered full compensation for all labor, equipment, materials, and tools necessary to accomplish the specified work in a manner satisfactory to the Engineer. Payment for encasing pile in rock socket with concrete shall be incidental to this Item.

ITEM 952. STEEL SHEETING POUND

Work under this item shall conform to the relevant provisions of section 950 of the standard specifications and the following:

Design of temporary excavation support measures shall include the influence of sloping backfill conditions, traffic and construction surcharges, and hydrostatic pressure. The Contractor is advised that installation of steel sheet piles may be difficult due to the presence of gravel and cobbles in the underlying glacial soils. Work required to remove any existing obstructions for the installation of the steel sheeting shall be incidental to the construction and shall be included in the unit price bid for this item.

The parameters for the design of temporary support of excavation in the existing soils are as follows:

Angle for Internal Friction	
Loose sand and silt	28º
Dense sand with gravel cobbles	37º
Angle of Friction between Steel and Soil	
Loose sand and silt	11º
Dense sand with gravel cobbles	17º
Cohesion	0
Moist Unit Weight	
Loose sand and silt	110 pcf
Dense sand with gravel cobbles	125 pcf
Design Groundwater Elevation	205 feet

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and payment under this Item shall be at the contract unit price per pound of steel sheeting installed in accordance with the above requirements. Such price shall be considered full compensation for all labor, equipment, materials, and tools necessary to accomplish the specified work in a manner satisfactory to the Engineer. Price shall include the costs for all work associated with the removal or abandonment in place of the steel sheeting as specified on the contract documents.

ITEM 991.1 CONTROL OF WATER, BRIDGE NO. U-02-030 LUMP SUM

The work to be performed under this Item shall include all pumping, sandbagging, cofferdams, barriers, earth and other measures, inclusive of optional sheeting, necessary for sufficient water control to accomplish the replacement and widening of Bridge No. U-02-030, including wingwalls MSE walls, and rip rap, in the dry. Work under this item shall consist of dewatering within the bridge and MSE wall work limits as shown on the plans to facilitate the construction of the bridge, wingwalls, MSE walls and rip rap. Water within the work area shall be discharged as specified in the environmental permits obtained for this project and as directed by the Engineer. No direct discharge shall be allowed into Ironstone Brook, the Blackstone River, or wetland areas during the dewatering operations. Dewatering shall be conducted to ensure that all structural concrete is placed and cured in the dry. For demolition purposes, dewatering shall be conducted for demolition of portions of the existing bridge as determined by the Engineer. It is the responsibility of the Contractor to determine the need and extent of dewatering required, sedimentation and dewatering techniques and controls and submit method and materials he/she proposes to use for approval by the Engineer.

The handling of flood flows and the protection of existing structures, and any or all of the finished construction during high water, are included in the scope of work under this item.

The Contractor shall schedule his work in three stages so that cofferdams at the east and west abutments/wingwalls and at the center pier are not in place at the same time. The cofferdam at the first of these three work areas shall be completely removed prior to beginning work on the second of these locations; and the cofferdam at the second of these three work areas shall be completely removed prior to beginning work on the third of these locations. The sequencing of these three locations shall be at the Contractor's discretion based on his schedule of work; however, the Contractor shall schedule his operations such that these cofferdam locations are constructed only once and all work required within each cofferdam is completed prior to beginning work in the other locations.

Plans and calculations for all the sandbagging, dikes, optional sheeting, and other water control measures shall be developed by the Contractor. These plans and calculations shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts and shall be submitted for approval prior to the start of construction. The Contractor shall use such equipment and shall perform the operations in such a manner that disturbances of the soil in the foundation area will be prevented. The Contractor shall keep the excavated area dry by such means that the water will be prevented from entering from the adjacent soils and adversely affecting the stability of the foundation material or supporting soils.

Item 991.1 Cont.

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 Ironstone Brook, the Blackstone River, or wetland resource areas. The water from the work areas shall be pumped either to a temporary settling tank, forebay basin, or other approved containment structure conforming to the Department's "Guidelines for Soil Erosion & Sediment Control". The containment structure shall be constructed so as to allow for the pumped water to pass through the structure with sediments settling out before outletting to an area enclosed by hay bales. The criteria that are implemented for the control of water must meet the following:

1. Approximately 70% sedimentation trapping efficiency shall be achieved with an enclosure adequately sized to prevent overtopping from dewatering and to provide the required filtering.
2. The outlet from the containment structure 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.

The control of water containment structure shall be maintained as follows:

1. Inspect at least twice daily during dewatering operations.
2. Repair any damage immediately.
3. Clean containment structure daily. Remove any debris immediately.
4. Remove sediments when accumulated deposits reach a depth of 6 inches.

The Contractor shall inspect hay bales that surround the outlet daily and shall immediately replace any that are damaged.

Placement of the dewatering containment structure will be as approved by the Engineer due to specific site conditions and staging operations of the Contractor.

The Contractor shall investigate and verify existing stream conditions, and evaluate the need for, and the type of protection and facilities required. Before commencing construction, the Contractor shall furnish the Engineer with details of the plan and methods he/she proposes to use for handling water including details for pumping and a pump discharge basin based on actual pumping needs and accomplishing the work. The Contractor may use sandbags or other types of protective facilities as approved by the Engineer. The furnishings of such plans and methods shall not relieve the Contractor of any of his responsibility for the safety of the work and for the successful completion of the project.

Item 991.1 Cont.

The height of any cofferdams and barriers shall be as shown on the plans to provide reasonable protection from flooding. All such temporary structures or facilities shall be safely designed, extended to sufficient depth and be of such dimensions and water-tightness so as to assure construction of the permanent work in the dry. They shall not interfere with proper performance of the work. Their construction shall be such as to permit excavation for the permanent work and any conflict shall be corrected at the sole expense of the Contractor.

Any pumping from within the areas of construction shall be done in such a manner as to prevent the possibility of movement of water through any fresh concrete. No pumping will be permitted during placing of concrete or for a period of 24 hours thereafter, unless it is done from a suitable sump properly located with sufficient pumping capacity to protect against damage from sudden rising of water. Any pumped water must be discharged in accordance with the requirements of relevant provisions.

Unless otherwise provided, or directed, all such temporary protective work shall be removed and disposed of in an approved manner when no longer required.

The Contractor shall be responsible for the scheduling of work under this item so as not to interfere with any sequence of operations developed for this project. Delays as a result of work required under this item shall not constitute a claim for an extension of contract time.

The Contractor is advised that the effectiveness of the water control method used will vary based on the field conditions and the time at which the actual excavation work is being performed. The Engineer has the right to order the Contractor to stop all excavation operations when in his judgment the Contractor's water control operations are failing to produce adequate results or are posing a threat to the environment.

BASIS OF PAYMENT

Payment for work under this Item shall be paid at the contract lump sum bid price, complete.

Payment for all water control work, including design for the dewatering operations used to maintain a water free excavation, shall include all labor, tools and equipment materials and installation, piping, pumping, maintenance, subsequent removal of all related materials and equipment all as outlined above; and restoration of site shall be included in the lump sum contract price bid under this Item.

ITEM 995.01 BRIDGE STRUCTURE, BRIDGE NO. U-02-030 LUMP SUM

The work under this Item includes all materials and labor required to complete the above structure as outlined under Section 995. The work includes precast integral abutments, approach slabs, highway guardrail transitions, folded plate girder superstructure units, concrete end diaphragms, high performance concrete deck overlay, bridge rails and asphaltic joint assemblies as shown on the bridge plans and the following:

The work under this Item does not include the demolition and removal of the existing bridge superstructure and substructure, the various classes of excavation, gravel borrow, instrumentation, or other work in the contract specifically noted for payment under other Items.

CEMENT CONCRETE MASONRY

4000 PSI, 1.50-Inch 565 Cement Concrete
4000 PSI, 0.75-Inch 610 Cement Concrete
4000 PSI, 0.75-Inch 585 Cement Concrete HP
5000 PSI, 0.75-Inch 685 Cement Concrete HP

The work to be done under these headings shall conform to the same requirements as specified and detailed under item 995.01.

PRECAST ABUTMENT SEGMENTS

This work shall consist of fabricating, delivering, and erecting the precast/post-tensioned abutments and related material in accordance with the plans and specifications. The work under this Section shall conform to the relevant requirements of the current AASHTO Standard Specifications for Highway Bridges, and shall be supplemented by the relevant provisions of "The Manual For Quality Control For Plants and Production of Precast and Prestressed Concrete Products", Prestressed Concrete Institute Publication Number MNL-116-85, except as noted herein.

Cement Concrete Masonry
All cement concrete masonry shall conform to Section 901 of the Standard Specifications and to the following:
Precast concrete abutment segments..4,000 PSI, 1.50 IN, 565 Cement Concrete
Self-consolidating concrete.....5,000 PSI, 0.375 IN, 710 Cement Concrete

Precast Concrete
Concrete for the precast concrete abutment segments shall be made in accordance with the pertinent provisions of M4.02.14.

Post-tensioning Bars
Post-tensioning Bars shall be 1-inch diameter bars conforming to ASTM A 722/A 722M, Grade 150, Type II, and shall be galvanized. Ducts for post-tensioning bars shall be galvanized corrugated steel.

Item 995.01 Cont.

Self-Consolidating Concrete

Self-Consolidating Concrete (SCC) is a highly flowable and non-segregating concrete mixture that spreads into place and is able to flow and fill all corners of the formwork with little or no mechanical vibration. SCC shall only be placed as shown on the plans to fill voids for construction of precast concrete elements and connecting joints. SCC shall not be used for deck slabs, abutment diaphragms, or to fill any other element that is sloped. SCC shall only be placed when the concrete temperature is between 60 and 90 degrees F.

Self-Consolidating Concrete shall conform to the relevant requirements of Section 901, M4.00.00 and M4.02. and shall be modified as described below:

Cement

Cement shall be Type II Portland Cement, AASHTO M 85 (ASTM C 150), or Blended Hydraulic Cement, AASHTO M 240 (ASTM C 595) and ASTM C 1157. When Blended Hydraulic Cement is substituted for Portland Cement, use ASTM C 1567 to verify that expansion is less than 0.1 percent at 16 days. Do not exceed the 30 percent total pozzolan limit when adding fly ash to the Blended Hydraulic Cement. Documentation of the total pozzolan content shall be submitted with the mix design.

Aggregate

Use Fine Aggregate meeting AASHTO M 6 physical properties and meet combined gradation requirements of Table A below. Do not exceed percentages of deleterious substances as outlined in AASHTO M 6 for Class A aggregates, using Class B for material finer than the No. 200 sieve.

Use Coarse Aggregate meeting AASHTO M 80 physical properties and meet combined gradation requirements of the table below. Do not exceed percentages of deleterious substances as shown in AASHTO M 80, Table 2, for Class A aggregates.

Aggregate Gradations
(Percent Passing by Dry Weight of Aggregate)

Sieve Size	⅜ inch Operating Bands
¾ inch	–
½ inch	100
⅜ inch	65 – 95
No. 4	50 – 80
No. 8	30 – 60
No. 16	20 – 45
No. 30	12 –35
No. 50	5 – 20
No. 100	2 – 12
No. 200	0 – 2

Item 995.01 Cont.

Water
Use potable water or water meeting ASTM C 1602, including Table A.

Cement Concrete Additives

A. High Range Water Reducing Admixture (HRWR)
   Use of a high range water reducing admixture is mandatory for producing SCC. High range water reducing admixture must meet the requirements of AASHTO M194 Type F or Type G, and must be on the MassDOT list of approved admixtures. High range water reducing admixture must be called out in manufacturer's literature as being suitable for use in self-consolidating concrete.
B. Viscosity Modifying Admixtures (VMA)
   VMA use is allowed to meet the stability and segregation resistance requirements for the SCC mixture. VMA shall comply with the ASTM C 494 Type S. Do not exceed manufacturer recommendations for the use of the viscosity modifying admixture.

Mix Design Requirements
Design and proportion mix in accordance with ACI 301 and any project specific criteria. The cementitious system shall be designed to mitigate potential alkali-aggregate reactivity. A minimum of 20 percent by weight of the total cementitious system shall be used when using fly ash. Placed concrete shall have an air content between 5.0 to 7.5, with a Slump Flow in the range of 22 to 28 inches. A Visual Stability Index rating of 0-1 is required, AASHTO TP 80. Passing ability as measured per AASHTO TP 74 shall not differ from Slump Flow by more than 2 inches. A Hardened Visual Stability Index (HVSI) rating of a HVSI = 1 stable, is required, AASHTO PP 58.

The Maximum nominal size of coarse aggregate shall be as follows:

1. Not larger than $^1/_3$ of the narrowest dimension between sides of forms.
2. Not larger than $^1/_3$ the depth of slabs.
3. Not larger than ¾ of the minimum clear distance between reinforcing bars or between bars and forms, whichever is least.

Water/cement ratio shall not exceed 0.40 as calculated by the following formula:

$$\frac{W}{C} = \frac{Water}{Cement + Pozzolan}$$

Testing Requirements
Changing the mix design shall not be accepted and approved by the Research and Materials Division without the preparing, testing, and approval of trial batches for the revised mix design.

Item 995.01 Cont.

A test placement of the SCC mix design shall be performed in the presence of a qualified representative from the Research and Materials Division and the Contractor. During test placement, demonstrate appropriate quality tests and associated procedures including, but not limited to temperature, slump flow, Visual Stability Index, air content, casting strength specimens, Passing Ability of SCC by J-ring (AASHTO TP 74), and Static Segregation of Hardened Self-Consolidating Concrete Cylinders (AASHTO PP 58).

Additionally, each batch of SCC delivered to the project site shall be tested prior to placing. Tests shall include slump flow (AASHTO TP 73), visual stability index (AASHTO TP 80), and air content in accordance with to AASHTO T 152 meter Type B. Do not rod, vibrate, or tap the bowl.

If the first determination of slump flow, visual stability index, or air content fails, immediately retest. If the second test meets specification, immediately retest. The batch shall be rejected on two failed determinations.

Drawings

Detailed working or shop drawings will be required in accordance with the pertinent provisions of Subsection 5.02. Working drawings shall show the number and type of segments; location and spacing of strands and tensioning load to be applied per strand; span length from centerline to centerline of anchor rods; total length of beams; skew angle; and locations, type and size of sleeves and inserts; location; type and size of handling hooks, steel reinforcement and all other information required for proper fabrication and handling of the segments.

The Contractor shall provide an erection plan and erection details specific to the structure shown on the Plans. Erection details for the prefabricated units shall be complete in every detail, including handling points, section lengths, temporary supports or shoring, and the method of installation of the units. Additionally, the drawings shall indicate the dimensions of all prefabricated units, lifting loads of all components and steel reinforcement layout. The contractor is responsible for the stability of the precast segments prior to casting the closure pours for the folded plate girder units and the end diaphragms.

Concrete mix designs shall be part of the shop drawing submittal. Mix designs shall include aggregate specific gravity, absorption, percent fracture, fineness modulus and gradation.

Plant

Precast concrete products shall be manufactured in a plant meeting the requirements of Subsection 4.02.14A and as follows:

Item 995.01 Cont.

Precast concrete products shall be manufactured in accordance with Subsection 4.02.14A in a Precast/Pre-stressed Concrete Institute (PCI) Certified facility. An alternate facility may be used at the discretion of the Engineer.

Inspection Facilities

Inspection facilities shall meet the requirements of Subsection 4.02.14 and as follows:

The Contractor shall provide a private office at the fabrication plant for inspection personnel authorized by the Department. The office shall have an area not less than 100 square feet and shall be in close proximity to the work. The office shall be climate controlled to maintain the temperature between 65°F and 85°F, lighted and have the exit(s) closed by a door(s) equipped with a lock and 2 keys which shall be furnished to the Inspector(s). The office shall be equipped with a desk or table having a minimum size of 48 inches by 30 inches, 2 chairs, a telephone, telephone answering machine, line data port, plan rack and 2-drawer letter size file cabinet with a lock and 2 keys which shall be furnished to the Inspector(s).

The facilities and all furnishings shall remain the property of the Contractor upon completion of the work. Payment for the facilities, heating, lighting, telephone installation, basic monthly telephone charges and all furnishings shall be incidental to the contract.

Notice of Beginning Work

The Contractor shall give the Engineer a minimum of two weeks notice prior to beginning work. The Contractor shall advise the Engineer of the production schedule and any changes to it. If the Contractor suspends work on a project, the Engineer will require 48 hours notice prior to the resumption of work.

Inspection

Quality control shall be performed in accordance with Subsection 4.02.14H and as follows:

Quality Control Inspectors (QCIs) shall have a valid PCI Quality Control Certification Level I, Level II or Level III. Personnel performing concrete testing shall hold a current ACI Field Testing Technician Grade I Certification or equivalent, or work under the direct supervision of an ACI certified technician.

Rejections

Rejected material and workmanship shall be corrected or replaced by the Contractor.

Item 995.01 Cont.

Forms and Casting Beds

Form dimensions shall conform to the approved shop drawings. Forms shall be well constructed, carefully aligned and sufficiently tight to prevent leakage of mortar. Forms that do not maintain the plan dimensions within allowable tolerances during concrete placement shall be rejected.

Abutment segments shall be match cast to ensure a precise fit up in the field.

Wood forms shall be sealed with a material to prevent absorption. The sealer shall be applied and cured in accordance with the manufacturer's recommendations.

Forms shall be cleaned of adherent material before each use. Forms shall be cleaned of all foreign matter and debris immediately prior to placing concrete. New forms shall be free from paint or other protective coatings.

Forms shall be treated with a non-staining bond breaking compound applied in accordance with the manufacturer's recommendations.

If the reinforcing steel or post-tensioning ducts have been contaminated with the bond-breaking compound, it shall be cleaned with solvent. No concrete shall be placed until the reinforcing steel and post-tensioning ducts have been inspected and accepted by the Engineer.

Voids and Inserts

Voids shall be non-absorbent. The out-to-out dimensions of the voids shall be within 2% of plan dimensions. Damaged voids shall be repaired in manner acceptable to the Engineer. Voids shall be stored, handled and placed in a manner that prevents damage. Residue from void placement shall be entirely removed from the forms before beginning or continuing the concrete placement.

Voids shall be located accurately, anchored securely, capped and vented. Any portion of a void that is displaced beyond the allowable dimensional tolerances shall be cause for rejection of the abutment segment.

Cast in place threaded inserts shown on the plans shall be accurately located and securely fastened. Inserts installed to erect forms in the field shall be recessed a minimum of 1 inch.

Concrete Placement

The first two loads of concrete from each placement shall be tested for temperature, air entrainment, and slump. If the first load is unacceptable, the second load shall be tested as the first. This process shall continue until two consecutive loads are found acceptable. After two consecutive loads are found acceptable, the frequency of testing shall be at the discretion of the Engineer.

Item 995.01 Cont.

Concrete shall be tested if there is a change in the dosage rate of any admixture, a change of 2 inches or more in slump or a change of more than 5°F in mix temperature.

Any load of 1 cubic yard or less from a stationary mixer or 2 cubic yards or less from a transit mixer shall be tested for air entrainment, slump, and temperature prior to being placed in the form.

Concrete shall be placed as nearly as possible to its final location. The depth of a lift shall be controlled in order to minimize entrapped air voids in conventional concrete castings. The maximum depth of an unconsolidated lift shall be 18 inches in conventional concrete castings. Concrete shall be vibrated with internal or internal and external vibrators in conventional concrete castings. External vibrators shall not be used alone. Internal vibrators shall be inserted vertically and penetrate the lower layer of concrete by at least 4 inches. The vibrators shall be inserted to assure that the radii of action of the vibrators overlap. The vibrators shall be held in position from 5 to 15 seconds. Vibrators shall not be used to move concrete horizontally. In concrete that is made self-consolidating by the addition of a polycarboxylating agent the amount of vibration and maximum depth of lifts shall be determined during the trial batching process with input from the Engineer, the Manufacturer's Technical Representative, and the Contractor.

When concrete placements are interrupted, no more than 60 minutes shall elapse from the time of the beginning of the placement and the resumption of the concrete placement when the concrete temperature is below 75°F. When the concrete temperature is above 75°F, the elapsed time shall be reduced to 30 minutes. Cold joints shall make the unit subject to rejection.

Abutment Segment Curing

Immediately after the concrete has been finished, the product shall be covered with an impermeable barrier to prevent moisture loss. The barrier shall be tight to the form and securely fastened. The exposed surface of the concrete shall be kept moist. The Contractor shall monitor and record the concrete temperature during the initial curing cycle.

After the product has been removed from the form, moist curing shall continue until it has reached design strength. All surfaces of the product shall be kept moist and the product shall be placed in a moisture retention enclosure with a relative humidity not less than 80%. The product shall not be exposed to temperatures below 50°F until design strength is achieved.

Item 995.01 Cont.

Membrane curing compounds shall not be used without the approval of the Engineer. If approved, the compound shall be applied in strict accordance with the manufacturer's published instructions. The Contractor shall provide the Engineer with the product data sheet for the compound prior to application. The compound shall be applied immediately after stripping.

Curing self consolidated concrete placed within Abutment voids, around piling. An approved membrane curing compound shall be applied in strict accordance with the manufacturer's published instructions.

Finishing Concrete and Repairing Defects

Products fabricated under this Section shall meet Standard Grade finish requirements as defined in MNL 116.

Honeycombing, ragged or irregular edges and other cosmetic defects shall be repaired using a product from the MassDOT Qualified Construction Materials List. The repair, including preparation of the repair area, mixing, application and curing of the patching material shall be in accordance with the manufacturer's published instructions. Edges not exposed in the final product may be ground smooth with no further repair necessary if the depth of the defect does not ½ inches. Form ties shall be removed to a depth of not less than 1 inch from the face of the concrete and patched by a method approved by the Engineer.

Structural defects shall be repaired by a method approved by the Engineer. Structural defects shall include, but not be limited to exposed reinforcing steel or strand, cracks in bearing areas, through cracks and cracks 0.013 inches in width that extend more than 12 inches. The Contractor shall submit a proposed repair procedure for structural repairs to the Engineer. No structural repairs shall be made without the Engineer being present. The Engineer shall be given adequate notice before beginning repairs.

Chamfers and drip notches shall be made smooth and uniform. Keyways shall be sandblasted to remove mortar paste.

Tolerances

Tolerances for precast units shall be in conformance with the latest edition of MNL 116, as applicable.

Transportation and Storage

The precast products not be handled, moved or transported for a minimum of 14 days from casting or until the composite deck reaches a strength, f'_c, greater than 3200 PSI.

Item 995.01 Cont.

Prestressed products shall be transported so that the reactions with respect to the unit shall be approximately the same during transportation and storage as the product in its final position. The product shall be handled so that only a vertical force is applied to the lifting devices.

Stored products shall be supported above the ground on dunnage in a manner to prevent twisting or distortion. Products shall be protected from discoloration and aesthetic damage.

Units damaged by improper storing, hoisting or handling shall be replaced by the Contractor.

Segment Erection

Erection precast abutment segments. Segments shall bear directly on piles, not soil. Pile cut-off elevations shall be verified such that the beam seat elevations are achieved when segments are erected. The match cast joint between segments shall be grouted with an approved epoxy grout.

Post-Tensioning

Immediately before post-tensioning abutment segments the match cast joint shall be coated with an adhesive epoxy in accordance with the manufacturer's published recommendations. A lock-off tension of 89,300 pounds per bar shall be applied to lateral post-tensioning bars.

Recesses at ends of lateral post-tensioning ducts shall be filled with grout using the same type cement as that in the abutment segments. Prior to installing the grout, the stressing pockets shall be clean of any dirt, grease, oil, or other material that may prevent bonding. Grouting shall be completed within 10 days of lateral post-tensioning. Erection of superstructure shall not be allowed until post tensioning is complete.

End anchorage, Ducts & Grout

End anchorage shall be approved by the Engineer. They shall be shown in detail on the working drawings, and shall be formed in such a manner that 2 inches of cover is provided to the ends of the post-tensioning bar in the final product. They shall consist of an anchor plate and an anchor nut and shall be in accordance with ACI 3.18 Section 18.21 and exceed the requirements part of the PTI acceptance standards for post-tensioning systems. Grout tubes shall be installed at each duct in each end of each segment for a total of 4 grout tubes required per post tensioning duct. Ducts shall be galvanized steel corrugated ducts. Grout for post tensioning ducts shall a non-shrinking type approved by the Engineer.

Item 995.01 Cont.

FOLDED PLATE GIRDER SUPERSTRUCTURE

The work to be performed under this section shall include the design, fabrication, delivery, and erection of a folded plate girder superstructure. The work shall also include the design, fabrication, delivery, and erection of utility supports, as indicated on Sheet B12 of B19, to support a future gas main. The folded plate girder superstructure shall consist of four (4) steel folded plate girders, reinforced concrete deck slabs cast compositely with the girders, reinforced concrete safety curbs cast integrally with the deck, and cast-in-place reinforced concrete closure pours anchor bolts, and erection pads as shown on the bridge plans, and as follows:

The folded plate girder superstructure shall be instrumented and monitored in accordance with the Item 160.109, "Instrumentation."

General

Design calculations and complete working drawings shall be prepared by, the folded plate girder superstructure shall be fabricated by, and the folded plate girder units shall by delivered to the site by:

Highway Bridge Services, L.L.C.
Attn: Dr. Atorod Azizinamini, PE
Technology Park-University of Nebraska
4701 Innovation Drive, Suites 106
Lincoln, NE 68521
(402) 472-3029
azziz@h-b-s.org

The contractor shall purchase the folded plate girder from Highway Bridge Services, within one week of the contract award.

The folded plate girder units shall be erected by the contractor.

Highway Bridge Services, L.L.C., hereafter referred to as HBS, shall provide material certifications for all material incorporated into the folded plate girder superstructure in accordance with Subsection 5.03 and Subsection 6.01.

Item 995.01 Cont.

Design

HBS shall submit a Design Report to the Engineer for review as specified in Subsection 5.02 and includes the following in separate sections:

1. Drawings sufficiently detailed to support design concept and erection including listing of all material requirements and notch toughness as appropriate for structural steel
2. (Explicit) instructions for future load rating by MassDOT forces
3. A description of locations and types of instrumentation with instruction for baseline readings and methods to correlate readings to design and
4. An attachment, furnished after construction, that provides load ratings consistent with MassDOT policy to load rate structures after construction is complete.

HBS shall also provide the following information, in a tabular format, to allow MassDOT to carry out independent calculations for checking the design of the superstructure for the Service, Fatigue and Strength limit states in accordance with AASHTO LRFD Bridge Design Specifications (2007 Edition), Section 3.4.1. Distribution factors for shear and moment along each girder at every tenth point for strength, service and fatigue limit states.

1. Distribution factor for calculating live load deflections for each girder at every tenth point.
2. Short and long term section properties for composite sections for each girder at every tenth point.
3. Shear and moment for Dead load (DC1 and DC2), Future wearing surface (DW), live load (LL) and vehicular dynamic load (IM) at every tenth point along each girder
4. Live load deflection for each girder, at every tenth point.
5. Resulting stresses in the bottom flanges of the folded plate girders during pick up and erection

These plans and calculations shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts and shall be submitted to the Engineer for approval after the Contract has been awarded, and before any working drawings have been prepared or shop work is commenced.

The design shall be performed in accordance with the following specifications:

1. AASHTO LRFD Bridge Design Specifications, 4th Edition, 2007 including 2008 and 2009 Interims
2. Massachusetts Department of Transportation (MassDOT) LRFD Bridge Manual, 2009
3. AASHTO/AWS Bridge Welding Code (ANSI/AASHTO/AWS D1.5:2008 with 2009 Interims)

Item 995.01 Cont.

HBS shall design the members for loads generated during transportation, erection and other construction operations as well as for service and ultimate loads.

The superstructure shall be designed for the HL-93 Loading.

The folded plate girder superstructure shall be designed to support a future 8-inch diameter gas main load of 89 PLF and utility supports spaced at a maximum length of 10 feet.

For the Service limit state, apply Service II load combinations and limit maximum principal tensile stress to 95% f_y.

The steel folded plate girders shall be proportioned such that the failure mode is ductile at ultimate strength. Local buckling of the webs and flanges shall not govern the design.

HBS shall provide load rating factors (RF) for the HL-93, H20, Type 3, and Type 3S2 rating vehicles in accordance with the AASHTO Manual for Bridge Evaluation (MBE), 1st Edition, 2008 according to the Load and Resistance Factor Rating (LRFR) method, and Chapter 7 of the MassDOT LRFD Bridge Manual, 2009.

HBS shall provide superstructure reactions for dead load (DC), dead load of wearing surface and utilities (DW), live load (LL), vehicular dynamic load (IM), wind load (W), wind on live load (WL), braking forces (BR), thermal forces (TU), water load and stream pressure (WA), and ice load (IC) on the working drawings.

The girder shall be design such that the finished top of deck elevations are achieved after all the dead load has been applied.

In addition, HBS shall provide live load distribution coefficients, factored shear, factored moments, dead and live load deflections, factored shear resistance, and factor moment resistance in tabular format at tenth points along each girder for each design and rating load combination. This information will be sufficient to allow MassDOT to perform load ratings in the future for permitted vehicle using a line girder analysis.

The expected centerline dead load and live load deflections shall be identified.

The Engineer will require 45 calendar days for review and approval or rejection and return of working drawings.

Working Drawings

After the design calculations have been accepted and before any shop work is commenced, the Contractor shall submit complete sets of prints of the shop drawings to the Engineer as specified in Subsection 5.02 and Subsection 960.60 and as follows:

Item 995.01 Cont.

The drawings shall show the plan, elevation and sections of the prefabricated superstructure units as well as details for all appurtenances such as sole plates, bearing stiffeners, and flange separators. They shall indicate the haunch dimensions; haunch thickness at tenth points along the beam; shear stud connector spacing, size, and dimensions; concrete deck thickness, width, and length; and reinforcement bar sizes, spacing, shapes, and dimensions. In addition, the working drawings shall show details of the closure pour between the precast deck units.

The Contractor shall provide an erection plan and erection details specific to the structure shown on the Plans. Erection details for the prefabricated units shall be complete in every detail, including handling points, section lengths and the method of installation of the units. Additionally, the drawings shall indicate the dimensions of all prefabricated units, lifting loads of all components and steel reinforcement layout.

Steel Folded Plate Girders

All structural steel shall conform to section 960 of the Standard Specifications and to AASHTO M270 Grade 50. The steel shall be galvanized in accordance with AASHTO-M111.

Materials shall meet the requirements specified in the following subsections of Division III - Materials:

Structural Steel.....M8.05.0
High Strength Bolts.....M8.04.0
Paints and Protective Coatings.....M7.00.0
Reinforcing Bars.....M8.01.0
Epoxy Coated Reinforcing Bars.....M8.01.7
Shear Stud Connectors.....M8.04.1

The bare steel girders shall be constructed to be level in the undeflected condition. The steel folded plate girders shall not be cambered.

The deck cross slope and vertical curve shall be accommodated by means of a haunch between the top of the girder and the bottom of the deck slab.

The Contractor will be required to submit to the Department's Inspector, for approval, three certified copies of the mill test reports for each heat number of steel furnished. These certificates shall certify compliance with the specifications and shall give the chemical and physical analysis of the metal. Any cost involved in furnishing the certificates shall be considered incidental to the work. These reports shall be given to the Verification Inspector in advance of shipping so that this inspector has sufficient time to properly review the reports. No material shall be shipped until the reports are reviewed and approved by the Verification Inspector.

Item 995.01 Cont.

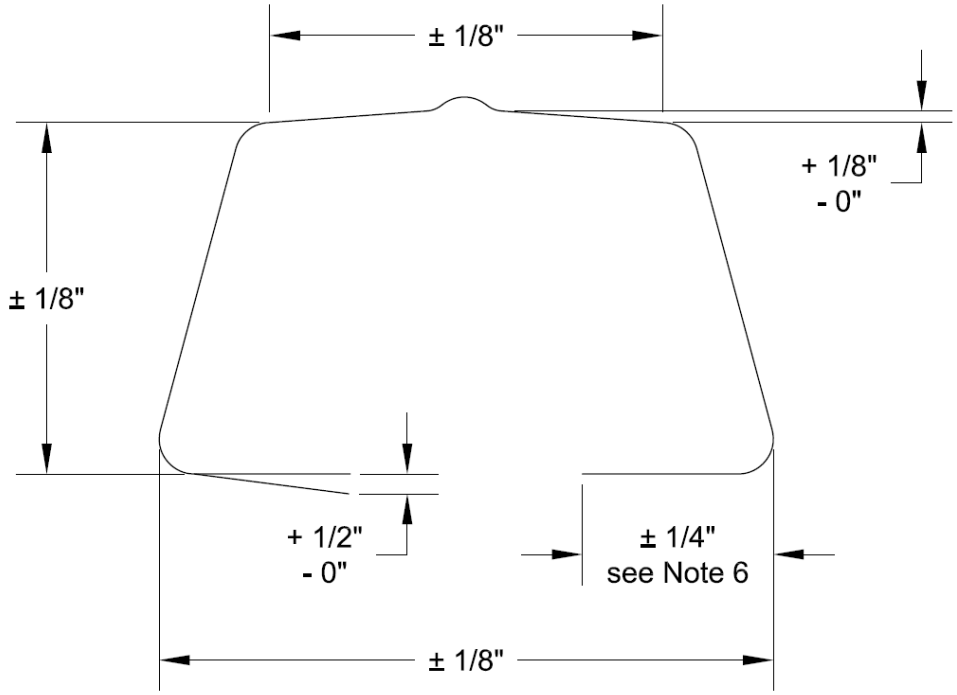
Fabricate bent, unwelded, load-carrying, rolled-steel plates from the stock plates so that the bend lines will be at right angles to the direction of rolling.

Cold bend such that no cracking of the plate occurs. Provide minimum bend radii, measured to the concave face of the metal, according to the following table:

Thickness in Inches (t)	Up to 1/2	Over 1/2 to 1
Bend radii	2t	2 1/2t

For break press forming, provide a lower die span of at least 16 times the plate thickness. Multiple hits are advisable.

The steel folded plate girders shall be fabricated to the following tolerances:



Notes:

1. Overall bottom width tolerance applies to bulkhead and flange separator locations
2. Sweep ± 1/8 inch per 12 feet of length
3. Sole Plate Flatness ± 1/8 inch
4. Positive camber + ¼ inch / -0" (exclusive of self weight deflection)
5. Twist ± 1/8 inch per 12 feet of length (1 inch maximum)
6. Combine tolerance for both bottom flanges +1/2 inch / - ¼ inch
7. Length ± 1/8 inch

Item 995.01 Cont.

Cement Concrete Masonry

All cement concrete masonry shall conform to Section 901 of the Standard Specifications and to the following:

Composite Deck, Closure Pour 4,000 PSI, 0.75 IN, 585 HP Cement Concrete Masonry

Safety Curb .....5,000 PSI, 0.75 IN, 685 HP Cement Concrete Masonry

The composite deck and safety curb shall be constructed in accordance with M4.02.14.

The work to be done under these headings shall conform to the same requirements as specified and detailed under item 995.01.

The manufacturing plant where the composite deck is cast and the manufacturing plant where the concrete is produced shall be approved by the Department prior to manufacturing. Mix designs shall be submitted to the Engineer for approval in accordance with Section M4.02.00. The units shall be manufactured in an approved enclosed building under the Engineer's control and inspection with a guaranteed provision to meet the requirements for curing and protecting the concrete as specified. The concrete shall be proportioned as specified in M4.02.06 and mixed in accordance with M4.02.10. No delay or shutdown of over 30 minutes duration in continuous filling of individual forms will be allowed. The units shall be cast true to line and dimensions, free from checking, cracking, voids, surface honeycombing and without requiring additional rubbing or patching.

All steel reinforcement (bars or welded wire fabric) shall be epoxy coated (M8.01.7) or galvanized steel (M8.01.8), conforming to the respective materials specifications.

The cast-in-place reinforced concrete end diaphragms at the abutment bridge seats shall be cast only after the deck assembly has been accepted. Closed cell foam shall be attached to the bridge structure to the limits and thickness as shown on the plans and the diaphragms shall be placed directly against it.

The reinforced concrete deck shall be cast compositely with the steel folded plate girders while the compression flange is facing up (i.e. while the girder is right-side-up.)

The finished surface of the composite reinforced concrete deck shall be smooth without any projections or depressions that could retain water.

Remove formwork from Folded Plate Girder Superstructure Units in accordance with the requirements in Subsection 901.67(A) for beams.

Item 995.01 Cont.

Fabrication

Highway Bridge Services will initiate the fabrication of the folded plate girders and casting the concrete deck over the folded plate girders, within one week of obtaining the purchase order from the contractor. Highway Bridge Service will make an arrangement to store the completed folded plate girder units, until contractor is ready to make an arrangement to ship them to construction site.

The steel folded plate girders shall be fabricated by bending a series of continuous steel plates along a plurality of preselected longitudinal lines to form a series of load-carrying girders, each girder having an upper flange section defining a bearing surface, a set of web sections extending downward from transitional bends formed on opposed lateral sides of the upper flange section, and a base section formed below the set of web sections, the base section including individual flanges.

The folded plate girder fabricator shall meet the requirements of AISC Category *Simple Steel Bridges*.

The fabricator shall submit a written QC plan to the Engineer for the fabrication that includes detailed final measurements for all pressed products.

Heat straightening shall not be permitted without written approval of Dr. Azizinamini of Highway Bridge Services, L.L.C.

Construction Sequence

1. Fabricate and galvanize the steel folded plate girder sections. *Note: HBS will start construction of folded plate girder units immediately upon receiving the purchase order from the contractor.*
2. Cast the concrete sub-deck.
3. Cast the safety curb.
4. Store the completed folded plate girder units until contractor is ready to pick them up.
5. Contact the Department to arrange for inspection of the folded plate girder units. The completed folded plate girders shall be inspected at the storage facility no more than 24 hours prior to shipment.
6. Contractor shall make arrangements to pick up the completed folded plate girder units from storage and shipment to the construction site. The completed folded girders shall be placed on the supporting abutments within 24 hours of shipment.
7. Upon receiving the completed folded plate girder units, place them over the erection pads.
8. Place reinforcement within closure regions and in turndowns (end diaphragms) at abutments as specified in the Plans.
9. The overlay, barrier installation, and all other remaining operations may be performed in any order.

Item 995.01 Cont.

Construction Methods

Within sixty days of the date of the Notice to Proceed, the Contractor shall submit an erection procedure to the Engineer. The submitted method of erection is subject to review, comment, and approval by the Engineer. The method must be submitted with detailed procedures which include drawings and calculations sufficient to enable the Engineer to determine the adequacy of the proposed method.

The preparation and submission of this erection procedure, including the information and calculations to be provided, shall be in accordance with the relevant requirements of Section 960.61, D. Erection, for beams and girders.

Highway Bridge Services will store the completed folded plate girder units at an inside facility and have them ready for contractor for pick up and delivery to construction site.

The safety curbs shall not be cast until after the deck has reaches a strength, f'c, greater than 2500 PSI. This operation will constitute completion of the construction for the four (4) folded plate girder units.

The Folded Plate Girder Superstructure Units shall not be shipped for a minimum of 14 days from casting the composite deck or until the composite deck reaches a strength, f'c, greater than 3500 PSI.

MassDOT will inspect the completed folded plate girder units, just prior to shipment to construction site.

Contractor should make the arrangement for shipping the completed folded plate girder units (folded plate girder plus concrete deck cast compositely) to the construction site, no sooner than one week before installation on bridge site.

Folded Plate Girder Superstructure Units shall be installed to the line and grade shown on the plans in accordance with the Contractor's approved erection procedures and in accordance with relevant provisions of these Standard Specifications.

Folded Plate Girder Superstructure Units shall not be stacked on top of each other either at the fabricator's yard, during transit or at the site. At all times blocking shall be located at the center line of bearing of the beam.

The Folded Plate Girder Superstructure Units shall be lifted only by the lifting hooks, and the utmost care shall be taken to prevent distortion of the beams during handling, transportation or storage. Under no circumstances are the Units to be handled in other than an upright position. HBS shall design and provide details for the lifting hooks. The lifting hooks shall be designed to meet the requirements for lifting devices as specified under Section 960.61, D. Erection.

Item 995.01 Cont.

Suitable spreaders shall be used during lifting so that only a vertical pull will be made on the hooks. A non-vertical lifting force may be permitted if prior written approval is given by the Engineer. This approval will be contingent on the Contractor demonstrating by calculations, prepared by a Professional Engineer registered in Massachusetts, that the Folded Plate Girder Superstructure Units will not be damaged by the non-vertical lifting force and by documentation that the capacity of the lifting hooks is adequate for the non-vertical lifting force.

Contractor must pick up the completed folded plate girders using the devices, methods and procedure specified by HBS. An alternate method may be used, if approved by Mass DOT and HBS.

As the Folded Plate Girder Superstructure Units are being erected, temporary blocking or bracing shall be installed to prevent the beams from accidentally rotating and tipping over and to maintain the units in the desired position for casting the closure pours. The bracing shall remain in place until the concrete in the closure pours has reached a strength greater than 0.80 f'c. The detail for this bracing shall be included with the erection procedure submittal.

Deviations from the approved working drawings shall not be permitted without written approval of Dr. Azizinamini of Highway Bridge Services, L.L.C.

Contractor shall cast the closure regions and turndowns in single operation. The concrete for closure pour regions shall meet Mass DOT 588 (HP) requirements.

The permissible out of vertical tolerance at reinforced composite deck edge adjacent to closure pours is ±1/8 inches.

The contractor and Highway Bridge Services, L.L.C. shall assist the Engineer in the preparation of as-built drawings by providing red-line markups of the contract plans indicating any variation between the information shown on the plans and the actual construction.

The erection pad for the folded plate girders shall conform to Section M9.16.1 of the Standard Specifications.

The anchor bolts shall be ASTM F1554 Grade 105 and conform to Section M8.01.5 of the Standard Specifications.

METAL BRIDGE RAILING (3 RAIL), STEEL (TYPE S3-TL4)

Type S3-TL4 Metal Bridge Railing shall conform to the applicable provisions of Section 975 of the MassDOT Supplemental Specifications dated June 6, 2006.

Item 995.01 Cont.

SCHEDULE OF BASIS FOR PARTIAL PAYMENT

At the time of 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 No. U-02-030 (BAM). 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 accuracy of quantities furnished by the Engineer for 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. U-02-030 (BAM). 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.

Item 995.01 Cont.

BRIDGE STRUCTURE, BRIDGE NO.U-02-030

SUB-ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
901.	4000 PSI, 1.5-Inch 565 Cement Concrete	51	CY		
904.	4000 PSI, 0.75-Inch 610 Cement Concrete	1	CY		
904.4	4000 PSI, 0.75-Inch 585 HP Cement Concrete	47	CY		
904.3	5000 PSI, 0.75-Inch 685 HP Cement Concrete	9	CY		
910.1	Steel Reinforcement for Structures - Epoxy Coated	20,300	LB		
960.12	Structural Steel M270 Grade 36 – Miscellaneous	525	LB		
971.	Asphaltic Bridge Joint System	64	FT		
970.	Bituminous Dampproofing	240	SY		
975.1	Metal Bridge Railing (3 Rail), Steel (Type S3-TL4)	105	FT		
XXX	Precast Abutment Segments	155	FT		
ZZZ	Folded Plate Girder Superstructure	200	FT		

TOTAL LUMP SUM FOR ITEM 995.01 _____

Item 995.01 Cont.

For purpose of estimating partial payments for the folded plate girder superstructure, the work will be separated into distinct phases as listed below and the value of each will be assigned a percentage of the amount listed in the above schedule of quantities:

Design Calculations Approval	5%
Working Drawing Approval	5%
Steel Folded Plate Girder Fabrication	35%
Folded Plate Girder Superstructure Unit Completion	25%
Folded Plate Girder Superstructure Unit Erection	10%
Closure Pour	5%
Certification	5%
As-Built Plan Approval	5%
Final Rating Approval	5%

A folded plate girder superstructure unit shall consist of a steel folded plate girder, the reinforced concrete deck slabs cast compositely with the girders, and reinforced concrete safety curbs cast integrally with the deck (if required per the plans).

Partial payment for folded plate girder superstructure unit completion shall be approved once all of the folded plate girder superstructure units are approved for shipment to the bridge site by the Verification Inspector.

Partial payment for folded plate girder superstructure unit erection shall be approved once all of the folded plate girder superstructure units are placed on the abutments in a stable configuration.

Partial payment for each phase will be based on the length of work completed, divided by the total length of the structure to be painted, or as determined by the Engineer.

The contract price shall be full compensation for designing, fabricating, delivering, erecting, and constructing precast concrete abutments and wingwalls, folded plate girder superstructure, including the steel folded plate girders, precast reinforced concrete composite deck slabs, reinforced concrete safety curbs, and cast-in-place reinforced concrete closure pours.

ITEM 996.31 MECHANICALLY STABILIZED EARTH WALL SQUARE YARD

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.

Mechanically Stabilized Earth (MSE) retaining 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 MSE retaining 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 facing panels shall be manufactured in a concrete products plant with 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:

- "Retained Earth MSE Wall System" by the Reinforced Earth Company – (703) 499-9818
- "VSL Retained Earth" by VSL Corporation – (703) 451-4300
- "TBSS Permanent MSE Retaining Wall System" by T&B Structural Systems, LLC – (888) 280-9858

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. Value engineering is not applicable to the work of this Item.

Item 996.31 Cont.

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.

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. Soil reinforcing and attachment devices located above the impervious membrane shall be designed for a service life of not less than 100 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 Standard Specification for Highway Bridges, Section 5.8. Where conflicting requirements occur the more stringent shall govern.

The MSE walls shall be dimensioned so that the factored bearing pressure does not exceed the factored bearing resistances shown on the Plans.

The MSE wall design shall follow the general dimensions of the wall envelope shown on the Plans. Top of leveling pad 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.

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.

Item 996.31 Cont.

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 of 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.

1.1 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:

Reinforced Concrete Facing Panels shall nominally measure 5’ high by 5' long as shown on the contract plans. 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.

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.

Item 996.31 Cont.

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 date of manufacture, production lot number, and the piece mark shall be clearly scribed on an unexposed face of each panel.

E. 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.

F. Reinforcing steel for precast panels shall be plain uncoated reinforcing bars in accordance with Section M8.

G. 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.

Item 996.31 Cont.

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.

1.2 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).

Item 996.31 Cont.

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).

1.3 Joint Materials

Installed to the dimensions and thickness in accordance with the Plans or approved shop drawings.

Provide either preformed EPDM rubber pads conforming to ASTM D2000 for 4AA, 812 rubbers or neoprene elastomeric pads having a Durometer Hardness of 55 ±5.

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 mutifilament 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.

1.4 Backfill Material

All backfill materials used in the MSE Walls volume shall conform to Gravel Borrow M1.03.0(b) and the following additional requirements:

Item 996.31 Cont.

Internal Friction Angle Requirements – Furnish material exhibiting an effective (drained) angle of internal friction of not less than 34 degrees, determined in accordance with AASHTO T 236. Run the test on the portion finer than the No. 10 sieve. Compact the sample at optimum moisture content to 95 percent of the maximum dry density, as determined in accordance with the requirements of AASHTO T 99. Test the sample at the compacted condition wotjpi addotopm pf water. No direct shear testing will be required when 80 percent or more of the material is larger than ¾ inch.

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.

Electrochemical Requirements - The backfill materials shall meet the following criteria:

Test	Requirements	Test Methods
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

1.5 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 6 inches thickness and 12 inches width and be placed at the design elevation shown on the plans within a 1/8 inch tolerance.

1.6 Impervious Membrane

The impervious membrane shall be a polymer sheet suitable for retaining water with dissolved deicing salts. The membrane shall be composed of polyvinyl chloride or polyethylene and have a minimum thickness of 30 mil. Joints between sheets of membrane shall either be heat welded or glued in accordance with manufacturer's recommendations. The impervious membrane shall be placed as high up on the wall as possible while staying below the bottom of the proposed highway guardrail posts. It shall be placed such that it is above all soil reinforcement and it completely covers all of the soil reinforcement located below it.

1.7 Crushed Stone for Drainage Layer

Crushed stone for use in the drainage layer above the MSE wall shall be 1/2 inch crushed stone conforming to the requirements of Section M2.01.5.

Item 996.31 Cont.

1.8 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. Soil reinforcing and attachment devices located above the impervious membrane shall be designed for a service life of not less than 100 years.

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.

Item 996.31 Cont.

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 and locations of sleeves, pipes, weepholes, and other embedded items to be installed through the walls.
7. Clearly indicated details for construction of walls or reinforcing elements around drainage, foundations, guardrail posts, 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. Methods of excavation and 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 cast in place retaining wall or abutment structure.
19. Details of impermeable membrane connection to facing panels and to runoff collection system.
20. Details of precast reinforced concrete coping and connection to the wall beneath.

CONSTRUCTION METHODS

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.

Item 996.31 Cont.

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.

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.

Foundation Preparation

The foundation for the structure shall be approved by the Engineer before erection is started. At each MSE wall foundation level, a precast reinforced or cast-in-place unreinforced concrete leveling pad shall be provided as shown on the plans. The leveling pad shall be cured a minimum of 12 hours before placement of wall blocks.

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. The Contractor shall coordinate the placement of the soil reinforcing elements to avoid conflicts with the proposed guardrail posts and utility poles. The Contractor will only be permitted to drive guardrail posts through the reinforcing strips or reinforcing mesh at specifically designed field penetrations. 36" diameter corrugated steel tubes shall be installed at the locations of the proposed utility poles (UP#8 and UP#40). The location of these tubes shall be coordinated with National Grid before final installation. The steel tubes shall be installed to a minimum depth of 7 feet from finished grade. The Contractor shall protect these steel tubes to ensure that no material enters the interior void prior to the utility company's installation of their permanent poles.

Item 996.31 Cont.

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.

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.

Roadway Runoff Collection System
The Contractor shall place an impervious membrane and drainage layer as shown on the Plans. The impervious membrane shall be placed just below the drainage layer. The impervious membrane shall slope away from the wall panels towards the collection system located beyond the end of the soil reinforcement elements. If angular fill material is to be placed above or below the impervious membrane, a suitable thickness of sand shall be used to protect the membrane from puncture. The membrane shall be continuous throughout the limits shown on the Plans with watertight seams at any splices. Repair any holes created during installation according to the membrane manufacturer's guidelines.

Item 996.31 Cont.

COMPENSATION

MSE walls will be measured in units of vertical square feet of retaining structure, according to the 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 foot for design, fabrication, transportation, and erection of MSE retaining walls, including excavation, 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:

- 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.

- 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, granular backfill, geotextile fabric, crushed stone for drainage, impervious membrane, and incidentals.

- All labor and equipment required to excavate for the wall 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 impervious membrane and wall drainage, place and compact backfill, and construct any other items necessary to complete the MSE wall.

- All temporary shoring necessary to perform the other work in this section - excluding steel sheeting identified under Item 952.

- All labor and equipment required to install corrugated steel sleeves for permanent utility poles. Utility poles will be furnished and installed by others.

As directed by the Engineer, excavation and replacement of any unsuitable materials beyond the MSE wall payment limits shown on the Plans will be measured and paid for as defined in Sections 120, 150, and 170.

ITEM 996.33 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 MHD inspectors and personnel on the job site for that day.

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 Manufacturer's Representative present at the site will be for each day approved by the Engineer at the unit bid price per day.