[] City Clerk [] Contractor [] Legal /CPO [] Department [] Auditor

City of Marlborough

DEPARTMENT OF PUBLIC WORKS

135 Neil Street, Marlborough, MA 01752

Contract Documents and

Specifications for

Simarano Drive Project

Contract ED 2014-21

Contact Person:
Evan Pilachowski, P.E., City Engineer
Department of Public Works
Engineering Division
135 Neil Street
Marlborough, Massachusetts 01752
Phone: 508-624-6910
Fax: 508-624-7699
dpw@marlborough-ma.gov

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Notice To Bidders

NOTICE TO BIDDERS

The City of Marlborough, the Awarding Authority, invites sealed bids for Simarano Drive Project in Marlborough, Massachusetts, **CONTRACT NO. ED 2014-21**. The work involves the following major items associated with Simarano Drive including full depth pavement reconstruction, drainage improvements, pavement milling, unclassified excavation, guardrail installation, curb installation, and traffic signal improvements. Estimated Project Value = $3,160,000. All bids for this project are subject to M.G.L., Ch. 30, §39M and Ch. 149, §44A-44J. Bidders are invited to a non-mandatory Pre-Bid Conference at the City's Engineering Division on **June 24, 2014 at 9:00 A.M.** to discuss the work. Further questions can be discussed by contacting the Engineering Division at (508) 624-6910 Extension 7200.

Sealed bids will be received at the Office of the City Engineer, Department of Public Works, Municipal Garage, 135 Neil Street, Marlborough, Massachusetts 01752 Tel. No. (508) 624-6910, Extension 7200 until **9:00 A.M. on July 3, 2014** at which time they will be opened and read aloud. Bids submitted after this time will not be accepted. Envelopes containing bids must be plainly marked on the lower left corner as **CONTRACT ED 2014-21 BID PROPOSAL** with the date and time of the bid opening. Specifications, plans and copies of the contract documents to be used must be obtained or may be examined at the Engineering Division of the Department of Public Works, Municipal Garage, 135 Neil Street, Marlborough, MA as of **June 19, 2014**. The City encourages specifications, plans and copies of the contract documents be obtained at no charge through the City's website located at www.marlborough-ma.gov ,(click Public Works, then DPW Procurement).

Each bid must be accompanied by a bid deposit in the form of a bid bond, or cash, or a certified check, or a treasure's or cashier's check, issued by a responsible bank or trust company, payable to the City of Marlborough in the amount of 5% of the contract bid price. A Performance and a Labor and Materials Payment Bond, each in the amount of 100% of the contract price, will be required of the successful bidder within ten (10) days of notification of contract award by the City pursuant to M.G.L. Chapter 149, §29. Insurance certificates indicating coverage for public liability, property damage and workman's compensation, in accordance with the contract requirements must be filed with the City by the successful bidder at the time of contract execution.

Workmen's Compensation and condition of employment as amended and other regulations which are included in the bid and contract documents, or any other state construction law or regulation. The Contract must comply with the most current Schedule of Prevailing Wage Rates established by the Massachusetts Department of Labor and Industries for the contract work, a recent list of which is included in the contract documents as provided for by Chapter 149, §26 through 27D as amended.

Equal opportunity and affirmative action in employment shall apply. In accordance with the provisions of EEO and anti-discrimination requirements included in the contract documents, the successful bidder, must agree to a contract obligation that affirms its willingness to maintain on the project a not less than five percent (5%) ratio of minority employee man hours in each job category.

Please be aware that the City is actively pursuing the necessary easements required to complete this project. The contract award, if made, for this project is anticipated to occur on or about September 1, 2014 and is contingent upon the City obtaining all necessary permanent or temporary easements associated with the Simarano Drive project by said date. The City will not sign the Notice to Proceed for this project until all easements are secured. Notice to Proceed is anticipated to be provided within fifteen (15) days of receipt of the City Engineer (or Legal Department) confirming that the City has obtained all necessary easements required for the project to be awarded.

In accordance with the provisions of applicable statues, laws, rules, regulations, ordinances and the City of Marlborough's Minority and Women's Business Enterprise (MBE/WBE) Program, all qualified contractors will receive consideration without regard to race, age, color, religious creed, gender, handicap, sexual orientation, veteran's status or national origin. The City reserves the right to reject any and all bids or parts thereof, waive any informality and to omit any item or items deemed advisable for the best interests of the public to do so.

CITY OF MARLBOROUGH
DEPT. OF PUBLIC WORKS
BY: Evan Pilachowski, P.E.
City Engineer

Instructions To Bidders

INSTRUCTIONS TO BIDDERS

ARTICLE 1 - BIDDER'S REPRESENTATION

1.1 Each General Bidder (hereinafter called the **"Bidder"**) by making a bid (hereinafter called **"bid"**) represents that:

1.1.1 The Bidder has obtained, read and understands the Contract Documents and the bid is made in accordance therewith.

1.1.2. The Bidder has visited the site and is familiar with the local conditions under which the Work has to be performed.

1.1.3. The documents are adequate and that the bidder will produce the required results.

1.2 Failure to so examine the Contract Documents and site will not relieve any Bidder from any obligation under the bid as submitted. The City of Marlborough will not be responsible for errors, omissions, or charges for extra work arising from any failure by the Bidder to familiarize itself with the bid/contract documents and existing conditions.

1.3 Each bid submitted in response to the bid documents is subject to all contract terms and conditions included herein, and any contract awarded will incorporate all of these contract terms.

ARTICLE 2 - CONTRACTOR'S CERTIFICATION

2.1. All employees who work on this construction site must have no less than 10 hours of OSHA-approved safety and health training. **See Chapter 306 of the Acts of 2004 and M.G.L. c. 30, §39S**.

2.2. The Contractor and all subcontractors on this project will be required to provide certification of this compliance with this requirement in accordance with the provisions of these Contract Documents.

ARTICLE 3 - REQUESTS FOR INTERPRETATION

3.1 Bidders shall promptly notify the City Engineer or designee of any ambiguity, inconsistency, or error which they may discover upon examination of the Contract Documents, the site, and local conditions.

3.2 Bidders requiring clarification or interpretation of the Contract Documents shall make a written request to the City Engineer. The City Engineer will answer such requests if received no later than five (5) business days, excluding Saturdays, Sundays, or holidays, before the date for receipt of the bids.

3.3 Interpretation, correction, or change in the Contract Documents will be made by written Addendum which will become part of the Contract Documents. Neither the City of Marlborough nor the City Engineer will be held accountable for any oral interpretations, corrections, or

changes.

3.4 Addenda will be faxed or emailed by the City Engineer or designee, to every individual or firm on record as having received a set of Contract Documents. It shall be the sole responsibility of the individual or firm to ascertain the existence of any and all addenda issued by the City of Marlborough as the Awarding Authority, whether or not the addenda is presented, faxed or emailed to or received by the Bidder.

3.5 Copies of addenda will be made available for inspection at the locations listed in the Advertisement where Contract Documents are on file.

ARTICLE 4 - PREPARATION AND SUBMISSION OF BIDS

4.1 Forms and Bid Preparation

Bids shall be submitted on the **"Form for General Bid"**.

4.1.1 All entries on the bid form shall be made by **typewriter or in ink**.

4.1.2 Sums shall be expressed in **both words and figures** in the space indicated on the bid form. Where there is a discrepancy between the bid sum expressed in words and the bid sum expressed in figures, the words shall control.

4.2 Wage Rates

4.2.1 This Project is subject to the schedule of prevailing wage rates as determined by the Commissioner of the Massachusetts Department of Labor and Workforce Development, Division of Occupational Safety and included elsewhere in the bid documents. (M.G.L. c. 149, §§26-27D inclusive, as amended) .

4.2.2 Refer to the wage rates incorporated herein, as attached Appendix C “State Wage Rates”

4.3 Bid Deposits shall be:

4.3.1 at least five percent (5%) of the greatest possible bid amount, considering all alternates;

4.3.2 made payable to the **City of Marlborough;**

4.3.3 conditioned upon faithful performance by the principal of the agreements contained in the bid, and

4.3.4 in the form of cash, certified check, treasurer’s or cashier’s check issued by a responsible bank or trust company, or a bid bond issued by a surety company licensed to do business in the Commonwealth of Massachusetts and satisfactory to the City of Marlborough as the Awarding Authority.

4.3.5 retained until the execution and delivery of the Owner/Contractor Agreement if they represent the bid deposit of one of the three (3) lowest responsible and eligible Bidders or, if no award is made, then at the

expiration of thirty (30) business days after the opening of the bids, Saturday, Sundays, and legal holidays excluded, unless forfeited by failure to sign the contract as hereinafter provided.

4.3.6 All bid bonds shall be retained by the City of Marlborough unless accompanied by a stamped self-addressed envelope.

4.4 Delivery of Bids

4.4.1 General Bids, including the bid deposit, shall be submitted on a form furnished by the City of Marlborough and enclosed in a **sealed envelope** with the following plainly marked on the outside lower left corner:

General Bid for:
• Name of Project and Contract Number
• Bidder's Name, Business Address, and Phone Number

The City of Marlborough will not be responsible for the premature opening of any sealed bid not properly identified.

4.4.2 Date and time for receipt of bids is set forth in the Advertisement.

4.4.3 Timely delivery of a bid to the location designated shall be the full responsibility of the Bidder. Any bid received after the time and date specified will not be considered.

4.4.4 If, at the time of the scheduled bid opening, the designated location for receipt of bids is closed due to uncontrolled events, such as fire, snow, ice, wind, or building evacuation, the bid opening will be postponed until the time specified in the Advertisement for delivery of bids on the next normal business day. Bids will be accepted until that date and time.

ARTICLE5 – ALTERNATES, if applicable

5.1 Each Bidder shall acknowledge Alternates in Section C on the Form for General Bid by listing the individual Alternate number and entering the dollar amount of addition or subtraction necessitated by the Alternate listed in the corresponding space.

5.2 Bidders shall enter on the Form for General Bid a single amount for each Alternate which shall represent the amount for work performed by the General Contractor.

5.3 In the event an Alternate does not involve a change in the amount of the base bid, the Bidder shall so indicate by listing the individual Alternate number and acknowledge the Alternate by inserting **"No Change", or "No Charge", "N/C" or "0"** in the corresponding space provided for that Alternate.

5.4 The low Bidder will be determined on the basis of the sum of the base bid and the accepted alternates.

ARTICLE 6 - WITHDRAWAL OF BIDS

6.1 Before Opening of Bids

6.1.1 Any bid may be withdrawn prior to the time designated for receipt of bids upon written request and received by:

Office of the City Engineer
Department of Public Works
135 Neil Street
Marlborough, MA 01752

Withdrawal of bids must be confirmed over the Bidder's signature by written notice post-marked or sent by facsimile on or before the date and time set for receipt of bids.

6.1.2 Withdrawn bids may be resubmitted up to the time designated for the receipt of bids.

6.2 After Opening of Bids

6.2.1 Bidders may withdraw a bid, without penalty, any time up to the time of Award as defined in paragraph 8.1, and upon demonstrating, to the satisfaction of the City of Marlborough, that a bona fide clerical error was made during the preparation of the bid. Failure to conclusively demonstrate a bona fide clerical error may result in forfeiture of the bid deposit.

6.2.2 Bidders may not change the price or any other provision in a manner prejudicial to the interest of the City or to fair competition. If a mistake and the intended bid are clearly evident on the face of the bid, the City of Marlborough may correct the mistake to reflect the intended correct bid and so notify the bidder in writing. The bidder may not withdraw a bid if a mistake is clearly evident on the face of the bid, but the intended correct bid is not similarly evident.

6.3 In the event of a General Bid Withdrawal after Opening of Bids, the City of Marlborough shall consider the bid from next lowest eligible and responsible bidder.

ARTICLE 7 - CONTRACT AWARD

7.1 Award means both the determination and selection of the lowest, responsible and eligible bidder by the City of Marlborough as the Awarding Authority.

7.2 The City of Marlborough will award the contract to the lowest responsible and eligible bidder, on or about September 1, 2014 and is contingent upon the City obtaining all necessary permanent or temporary easements associated with the Simarano Drive project by said date. The City will not sign the Notice to Proceed for this project until all easements are secured. Notice to Proceed is anticipated to be provided within fifteen (15) days of receipt of the City Engineer (or Legal Department) confirming that the City has obtained all necessary easements required for the project to be awarded, unless such time is mutually extended by the City and the apparent low bidder.

7.3 The Contract will be awarded to the lowest responsible and eligible Bidder, judged on the basis of information about the bidder's experience, performance on recent and current projects and appropriate references. The award of contract will be subject to execution of the contract by the Contractor within ten (10) calendar days of the date of notification of the contract award and submission of the bonds required herein from a surety company qualified to do business under the laws of the Commonwealth and in a form acceptable to the City, and all other documentation required by the contract documents.

7.4 The award of this Contract is subject to the approval of the Mayor and is subject to appropriation. Contracts without Mayor approval shall not be considered valid.

7.5 The City of Marlborough reserves the right to waive any informality in or to reject any or all Bids if it be in the public interest to do so.

7.6 The City of Marlborough also reserves the right to reject any bid if it determines that such bid does not represent the bid of a person competent to perform the work as specified, or if bid prices are not reasonable for acceptance without further competition.

7.7 As used herein, the term "lowest responsible and eligible bidder" shall mean the General Bidder whose bid is the lowest of those Bidders demonstrably possessing the skill, ability, the required manpower and equipment, and integrity necessary for the faithful performance of the work called for in the bid documents, and who meets the requirements for Bidders set forth in M.G.L. c.30 §39M(c) and is not debarred from bidding under M.G.L. c.29 §29F; and who shall certify that they are able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work.

7.8 The City of Marlborough intends to award one contract to the lowest responsible and eligible bidder. No award will be made to any contractor who can not satisfy the City that he/she has sufficient ability and experience in the work to be performed and sufficient capital to enable the Contractor to prosecute and complete the Work successfully within the time specified. The decision or judgment of the City's representative, on behalf of the City of Marlborough as the Awarding Authority, on these matters shall be final, conclusive and binding.

7.9 Evidence of prior experience must be submitted to the City of Marlborough prior to the award of a contract with the successful bidder. The General Contractor that performs the substantive portion of the principal work described in the Specifications must have a documented record of at least five (5) years of reliable performance in similar work, and must submit references to substantiate it is a "responsible and eligible bidder" as defined in **M.G.L. c. 30, §39M** by providing a complete list of all Massachusetts communities for which the company has provided similar services, including contract amounts, names and telephone numbers of contact officials. If bidders experience is less than five (5) years, the bidder shall provide similar information for private sector companies for which the bidder has performed for similar projects.

7.10 The General Bidder must have successfully completed at least one (1) contract for a project similar in scope, size, and complexity to the Work specified herein and must identify a reference for same.

ARTICLE 8 - FORMS REQUIRED FOR CONTRACT APPROVAL

8.1 Upon Award, the Bidder shall complete the following forms to ensure prompt contract validation. These forms will be provided to the selected Bidder by the City of Marlborough

through its Engineering Division. Submit (5) originals of the contract documents per City policy.

8.2 Owner/Contractor Agreement and Form of Corporate Vote.

8.3 Form of Contractor's Equal Employment Certification in accordance with the provisions of the General Conditions.

8.4 Form of Performance Bond and Form of Payment (Labor & Materials) Bond must be submitted in the amount of one hundred percent (100%) of the total contract amount by the General Contractor on the City of Marlborough's form or similar, in accordance with provisions of the General Conditions. **The dates on the bonds must coincide with the contract date, contain the signature of both the Contractor and the Surety, and a current original Power-of-Attorney must be attached to each bond.**

8.4.1 Both the General Bidder and Surety must sign bond with Surety's impressed seal or otherwise be an original. Any such bond must be issued by a surety company licensed by the Commonwealth's Division of Insurance and listed in the most recent United States Treasury Department Circular 570 – Surety Companies Acceptable on Federal Bonds.

8.4.2 Bond must be made out to the City of Marlborough.

8.4.3 Certification of full force and effective must be dated.

8.5 Insurance and Indemnification

8.5.1 Certificates for the General Contractor are required at the time of contract execution and must be submitted in accordance with provisions of the General Conditions. The City of Marlborough must be included as a named additional insured on all liability policies except where prohibited by law.

8.5.2 General Contractors must indicate on special perils insurance or installation floater if stored materials are covered.

8.5.3 The General Contractor shall indemnify from harm to any of its employees, the City's employees or agents of the City and/or their employees or members of the public by providing evidence of personal and vehicular liability, and property damage insurance coverage in the amount specified in Section 28 of the General Conditions.

8.6 Statement of Management on Internal Accounting Controls and a Statement prepared by a CPA expressing an opinion to the state of Management Controls, as required by M.G.L. c.30 §39R. **This applies to all General Contractors with contracts of $100,000 or more.** Samples are provided in the Contract Document section of the bid documents.

8.7 At time of contract execution, the General Contractor must submit a completed Certificate of Tax Compliance pursuant to M.G.L. Ch. 62, §49A and of Unemployment Payments pursuant to Ch. 151A, §19A.

ARTICLE 9 - CONTRACT VALIDATION

9.1 The Owner-Contractor Agreement shall not be valid until signed by the the Mayor and whose signature has been Attested to by the City Clerk, the Department Head, the Auditor, the Chief Procurement Officer and is Approved as to Form by the City Solicitor or the Assistant City Solicitor.

9.2 The Notice to Proceed for construction shall not be issued until the Owner/Contractor Agreement has been validated by the signature of the Mayor.

9.3 Incomplete or unacceptable submissions of forms required by paragraphs 9.2 - 9.8 will delay the validation of the Owner/Contractor Agreement by the Mayor.

ARTICLE 10 – APPLICABLE BID & OTHER LAWS

10.1 The bidding for and award of the contract for this project are subject to and in accordance with the provisions of either or both M.G.L. Ch.30, §39M as amended and M.G.L. Ch. 149, §44A – 44J inclusive.

10.2 The City of Marlborough is subject to the rules and regulations of the Architectural Access Board (521 CMR 1.00 et seq.), if applicable to the project.

10.3 Wherever in the Bid Documents, General Conditions, Contract, Plans or Specifications reference is made to the Massachusetts General Laws it shall be construed to include all amendments thereto effective as of the date of issue of the invitation to bid on the proposed work.

ARTICLE 11 – PERMITS, LICENSES AND FEES

11.1 The City of Marlborough will waive any fees for permits or licenses due to the City of Marlborough.

11.2 The General Contractor is responsible for securing permits and arranging inspections as required pursuant to applicable laws, rules, regulations and ordinances.

ARTICLE 12 – MISCELLANEOUS

12.1 The work will be substantially completed no later than **Two Hundred Ten Days (210) calendar days** following receipt by the Contractor of a written Notice to Proceed issued by the City. Liquidated Damages, but not as a penalty, will be assessed at a rate of $500.00 per calendar day beyond the date indicated.

12.2 No payments will be made for any extra charges such as shipping or delivery.

12.3 The City is exempt from Massachusetts Sales Tax and no bid shall include same. The Contractor may contact the City Auditor at 508-460-3774 for information on what forms are needed to purchase supplies without payment of taxes.

12.4 The specifications within require the performance of all things necessary, proper for or incidental to the provision of services or supplies specified herein. Any services mentioned in these specifications and all things not specified herein, but involved in carrying out their intent

and the complete and proper execution of the services are required by these specifications; the Contractor shall perform same as though they were specifically described and mentioned.

12.5 The successful Contractor will not be permitted to assign or underlet the contract, or assign either legally or equitably, any monies hereunder, or its claim thereto, without the previous written consent from the City as provided in the attached contract.

END OF SECTION

Form Of General Bid

CITY OF MARLBOROUGH
MARLBOROUGH, MASSACHUSETTS 01752-3812

FORM FOR GENERAL BID

To the Awarding Authority:

A. The undersigned proposes to furnish all labor and materials required for the **Simarano Drive Project, Contract ED 2014-21** in Marlborough, Massachusetts, in accordance with the accompanying plans and Specifications prepared by **Vanasse Hangen Brustlin, Inc. Union Station Suite 219, 2 Washington Square, Worcester, MA, 01604** for the contract price specified below, subject to additions and deductions according to the terms of the specifications.

B. This bid includes addenda numbered _____.

C. The proposed contract price is:

_____ dollars $_____.
(total bid in words) **(figures)**

The Total Bid Price includes Items 101. through 999. (based bid only).

For Alternate **No. _____** **Add** $_____; **Subtract** $_____

(Each Alternate shall be listed separately. Repeat preceding line for each alternate.)

D. The undersigned agrees that, if selected as general contractor, we will within ten (10) days, Saturdays, Sundays and legal holidays excluded, after written notification thereof by the Awarding Authority of a contract award and presentation thereof for signature, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials or payment bond, each of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority and each in the sum of one hundred percent (100%) of the contract price, the premiums for which are to be paid by the contractor and are included in the contract price; provided, however, that if there is more than one (1) surety company, the surety companies shall be jointly and severally liable *(effective August 8, 2008)*. Should the undersigned fail to fulfill any of the stipulations as hereinbefore set forth, the City shall have the right to retain as liquidated damages the amount of the bid security, which shall become the City's property. If the bid bond was furnished as bid security, it is agreed that the amount thereof shall be paid as liquidated damages to the City by the Surety.

The undersigned hereby certifies, in accordance with M.G.L. c. 30, §39M(c), as amended, and any other State and Federal Labor standards and regulations, that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration (OSHA) that is at least ten (10) hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee *(effective July 1, 2006)*; and that he will comply fully with all laws and regulations applicable to awards made subject to section forty-four A (44A) of Chapter 149.

The undersigned hereby agrees that they will not withdraw their bid within sixty (60) consecutive calendar days after the actual date of the opening of the Bids.

F. The undersigned further certifies under the penalty of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this paragraph, the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the commonwealth including:

- individuals and firms suspended or debarred by the Division of Capital Asset Management pursuant to M.G.L. c.29, § 29F and M.G.L. c.149, § 44C
- and does not include individuals or firms suspended or debarred by the Massachusetts Department of Transportation or any other agency of the Commonwealth of Massachusetts with authority to suspend or debar under M.G.L. c.29, § 29F or M.G.L. c.30, § 39R
- This list also does not include individuals or firms suspended or debarred by the Massachusetts Office of Attorney General pursuant to M.G.L. c.149, § 27C and M.G.L. c.149, § 148B
- the Massachusetts Division of Industrial Accidents pursuant to M.G.L. c.152, § 25C
- The United States Government on the list of contractors suspended or debarred by federal agencies net at http://epls.arnet.gov.

or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

G. The undersigned offers the following information as evidence of the contractor's qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

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

2. Ever failed to complete any work awarded? _____ If yes, please explain on separate sheet.

3. List all open recent contracts (public and private) with the names of awarding authority/owner on which you served as contractor or subcontractor for work of similar character as required for the above-named project. Attach supplemental sheet to provide a complete list.

Project Description Awarding Authority	**Architect/Engineer or Other Contact Name & Number**	**Contract Amount**
_____	_____	$ _____
_____	_____	$ _____
_____	_____	$ _____
_____	_____	$ _____
_____	_____	$ _____

4. **Bank Reference**: _____

Date _____

_____
(Company Name of General Bidder)

By _____
(Signature of Bidder)

_____
Print Name & Title of Person Signing Bid)

_____
(Business Address)

_____
(City, State and Zip Code)

_____
(Telephone Number)

_____
(Fax Number)

_____
Email

PS&E SUBMISSION
SIMARANO DRIVE
MARLBOROUGH, MA

	Item No	Quantity	Unit	Description	Unit Price	Amount
*	101.	1	A	CLEARING AND GRUBBING	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	102.1	1,000	FT	TREE TRIMMING	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	102.51	10	EA	INDIVIDUAL TREE PROTECTION	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	103.	10	EA	TREE REMOVED DIAMETER UNDER 24"	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	120.1	5,000	CY	UNCLASSIFIED EXCAVATION	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	141.1	85	CY	TEST PIT FOR EXPLORATION	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	142.	25	CY	CLASS B TRENCH EXCAVATION	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	144.	25	CY	CLASS B ROCK EXCAVATION	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	146.	3	EA	DRAINAGE STRUCTURE REMOVED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	151.	1,700	CY	GRAVEL BORROW	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	151.01	225	CY	GRAVEL BORROW - TYPE C	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	151.2	25	CY	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	156.	5	TON	CRUSHED STONE	($_____._____)	_____Dollars and _____ Cents ($_____._____)

	170.	9,100	SY	FINE GRADING AND COMPACTING	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	201.	26	EA	CATCH BASIN	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	202.	9	EA	MANHOLE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	203.	1	EA	SPECIAL MANHOLE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	204.	9	EA	GUTTER INLET	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	208.1	3	EA	DROP INLET TYPE CF	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	220.	60	EA	DRAINAGE STRUCTURE ADJUSTED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	220.2	40	FT	DRAINAGE STRUCTURE REBUILT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	220.3	4	EA	DRAINAGE STRUCTURE CHANGE IN TYPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	220.5	6	EA	DRAINAGE STRUCTURE REMODELED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	220.7	10	EA	SANITARY STRUCTURE ADJUSTED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	222.21	8	EA	FRAME & GRATE DROP INLET - MUNICIPAL STANDARD	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	222.3	51	EA	FRAME AND GRATE (OR COVER) - MUNICIPAL STANDARD	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	223.1	20	EA	FRAME AND GRATE (OR COVER) REMOVED AND STACKED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	224.12	26	EA	12 INCH HOOD	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	227.3	15	CY	REMOVAL OF DRAINAGE STRUCTURE SEDIMENT	($_____._____)	_____Dollars and _____ Cents ($_____._____)

	227.31	1,025	FT	REMOVAL OF DRAINAGE PIPE SEDIMENTS	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	230.112	10	FT	12 INCH CORRUGATED METAL PIPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	238.1	435	FT	10 INCH DUCTILE IRON PIPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	241.12	1,825	FT	12 INCH REINFORCED CONCRETE PIPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	241.15	150	FT	15 INCH REINFORCED CONCRETE PIPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	241.18	160	FT	18 INCH REINFORCED CONCRETE PIPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	242.15	2	EA	15 INCH REINFORCED CONCRETE PIPE FLARED END	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	258.	25	SY	STONE FOR PIPE ENDS	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	301.1	4	EA	WATERLINE RELOCATION AT STRUCTURES	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	303.06	60	FT	6 INCH DUCTILE IRON WATER PIPE (MECH JOINT)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	309.	625	LB	DUCTILE IRON FITTINGS FOR WATER PIPE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	357.06	10	EA	6 INCH GATE BOX	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	357.12	15	EA	12 INCH GATE BOX	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	358.	35	EA	GATE BOX ADJUSTED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	376.2	2	EA	HYDRANT REMOVED AND RESET	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	376.5	4	EA	HYDRANT ADJUSTED	($_____._____)	_____Dollars and _____ Cents ($_____._____)

	402.	1,650	CY	DENSE GRADED CRUSHED STONE FOR SUB-BASE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	403.	11,000	SY	RECLAIMED PAVEMENT FOR BASE COURSE AND/OR SUB-BASE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	415.	15,000	SY	PAVEMENT MICRO-MILLING	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	431.	525	SY	HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	440.	46,000	LB	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	443.	30.0	MGL	WATER FOR ROADWAY DUST CONTROL	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	450.90	7,070	TON	CONTRACTOR QUALITY CONTROL	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	451.	150	TON	HMA FOR PATCHING	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	452.	2,600	GAL	ASPHALT EMULSION FOR TACK COAT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	453.	10,500	FT	HMA JOINT SEALANT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	454.5	7,000	TON	LATEX MODIFICATION OF HMA	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	455.23	3,200	TON	SUPERPAVE SURFACE COURSE - 12.5 (SSC - 12.5)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	455.32	3,800	TON	SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC - 19.0)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	456.	7,000	TON	WARM-MIX ASPHALT PAVEMENT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	470.2	45	TON	HOT MIX ASPHALT BERM, TYPE A MODIFIED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	472.	100	TON	HOT MIX ASPHALT FOR MISCELLANEOUS WORK	($_____._____)	_____Dollars and _____ Cents ($_____._____)

*	482.3	7,000	FT	SAWING ASPHALT PAVEMENT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	482.4	50	FT	SAWING CEMENT CONCRETE PAVEMENT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	504.	235	FT	GRANITE CURB TYPE VA4 - STRAIGHT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	504.1	375	FT	GRANITE CURB TYPE VA4 - CURVED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	504.2	2	EA	GRANITE CURB TYPE VA4 - SPLAYED END	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	509.	115	FT	GRANITE TRANSITION CURB FOR WHEELCHAIR RAMPS - STRAIGHT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	509.1	195	FT	GRANITE TRANSITION CURB FOR WHEELCHAIR RAMPS - CURVED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	510.	100	FT	GRANITE EDGING TYPE SA	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	514.	28	EA	GRANITE CURB INLET - STRAIGHT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	515.	3	EA	GRANITE CURB INLET - CURVED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	570.3	9,750	FT	HOT MIX ASPHALT CURB TYPE 3	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	580.	215	FT	CURB REMOVED AND RESET	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	583.	350	FT	EDGING REMOVED AND RESET	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	590.	130	FT	CURB REMOVED AND STACKED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	593.	50	FT	EDGING REMOVED AND STACKED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	620.1	1,700	FT	STEEL W BEAM HIGHWAY GUARD (SINGLE FACED)	($_____._____)	_____Dollars and _____ Cents ($_____._____)

*	620.15	2,000	FT	STEEL W BEAM HIGHWAY GUARD - DEEP POST (SINGLE FACED)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	620.3	110	FT	STEEL W BEAM HIGHWAY GUARD - CURVED (SINGLE FACED)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	627.1	3	EA	STEEL W BEAM TERMINAL SECTION (SINGLE FACED)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	627.8	5	EA	STEEL BEAM HIGHWAY GUARD TANGENT END TREATMENT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	635.	2,300	FT	HIGHWAY GUARD REMOVED AND STACKED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	635.1	900	FT	HIGHWAY GUARD REMOVED AND DISCARDED	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	697.1	55	EA	SILT SACK	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	698.1	2,500	SY	GEOTEXTILE FABRIC FOR STABILIZATION	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	698.2	15	SY	GEOTEXTILE FABRIC FOR SUBSURFACE DRAINAGE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	698.5	1,500	SY	TURF REINFORCING MAT	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	701.2	270	SY	CEMENT CONCRETE WHEELCHAIR RAMP	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	702.	475	TN	HOT MIX ASPHALT WALK SURFACE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	703.	250	TON	HOT MIX ASPHALT DRIVEWAY	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	710.4	32	EA	BOUND - PLAIN GRANITE	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	751.	2,100	CY	LOAM BORROW	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	756.	1	LS	NPDES STORM WATER POLLUTION PREVENTION PLAN	($_____._____)	_____Dollars and _____ Cents ($_____._____)

	765.	15,000	SY	SEEDING	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	767.6	5	CY	AGED PINE BARK MULCH	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	767.8	1,500	EA	BALES OF HAY FOR EROSION CONTROL	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	769.	3,800	FT	PAVEMENT MILLING MULCH UNDER GUARD RAIL	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	776.836	9	EA	MAPLE - SUGAR 2-2.5 INCH CALIPER	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	804.3	1800	FT	3 INCH ELECTRCIAL CONDUIT TYPE NM - PLASTIC (UL)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	816.01	1	LS	TRAFFIC SIGNAL - RECONSTRUCTION LOCATION NO. 1	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	816.02	1	LS	TRAFFIC SIGNAL - RECONSTRUCTION LOCATION NO. 2	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	824.401	1	LS	RECTANGULAR RAPID FLASHING BEACON SYSTEM LOCATION NO. 1	($_____._____)	_____Dollars and _____ Cents ($_____._____)
*	824.402	1	LS	RECTANGULAR RAPID FLASHING BEACON SYSTEM LOCATION NO. 2	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	832.	335	SF	WARNING-REGULATORY AND ROUTE MARKER - ALUM. PANEL (TYPE A)	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	833.5	95	EA	DEMOUNTABLE REFLECTORIZED DELINEATOR - GUARD RAIL	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	833.7	8	EA	DELINEATION FOR GUARD RAIL TERMINALS	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	847.1	60	EA	SIGN SUP (N/GUIDE)+RTE MKR W/1 BRKWAY POST ASSEMBLY - STEEL	($_____._____)	_____Dollars and _____ Cents ($_____._____)
	852.	850	SF	SAFETY SIGNING FOR TRAFFIC MANAGEMENT	($_____._____)	_____Dollars and _____ Cents ($_____._____)

	853.1	6	EA	PORTABLE BREAKAWAY BARRICADE TYPE III	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	853.2	500	FT	TEMPORARY BARRIER	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	853.21	3,500	FT	TEMPORARY BARRIER REMOVED AND RESET	($_____.____)	_____Dollars and ____ Cents ($_____.____)
*	853.41	2	EA	TEMP.IMP.ATTENUATOR FOR SHLDR, INCAPABLE OF REDIRECTION	($_____.____)	_____Dollars and ____ Cents ($_____.____)
*	853.411	6	EA	TEMP.IMP.ATTENUATOR FOR SHLDR, INCAPABLE OF REDIRECTION R&R	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	854.014	5,000	FT	TEMPORARY PAVING MARKINGS - 4 IN. (PAINTED)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	854.036	1,700	FT	TEMPORARY PAVEMENT MARKINGS - 6 IN. (REMOVABLE TAPE)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	856.	550	DAY	ARROW BOARD	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	859.	21,000	DAY	REFLECTORIZED DRUM	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	864	1,000	SF	PAVEMENT ARROW AND LEGENDS REFLECTORIZED WHITE (PAINT)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	864.04	450	SF	PAVEMENT ARROW AND LEGENDS REFLECTORIZED WHITE (THEMOPLASTIC)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	866.04	14,650	FT	4 INCH REFLECTORIZED WHITE LINE (THEMOPLASTIC)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	866.12	2,050	FT	12 INCH REFLECTORIZED WHITE LINE (THEMOPLASTIC)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	867.04	16,000	FT	4 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
	867.12	765	FT	12 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)	($_____.____)	_____Dollars and ____ Cents ($_____.____)
*	874.	5	EA	STREET NAME SIGN	($_____.____)	_____Dollars and ____ Cents ($_____.____)

*	874.2	3	EA	TRAFFIC SIGN REMOVED AND RESET	($_____._____)	_____Dollars and _____ Cents ($_____.____)
*	874.4	15	EA	TRAFFIC SIGN REMOVED AND STACKED	($_____._____)	_____Dollars and _____ Cents ($_____.____)
*	874.7	1	LS	MISCELLANEOUS SIGNS REMOVED AND STACKED	($_____._____)	_____Dollars and _____ Cents ($_____.____)
*	983.3	10	CY	RIP RAP REMOVED AND RELAID	($_____._____)	_____Dollars and _____ Cents ($_____.____)
*	999.	1	LS	CONSTRUCTION STAKING	($_____._____)	_____Dollars and _____ Cents ($_____.____)
					TOTAL:	

BIDDERS INFORMATION SHEET

The following information is furnished by the bidder for the information of the City of Marlborough as the Awarding Authority.

1. Furnish the following information regarding the Bidder:

A. If an Individual or Proprietorship:

Name _____ Residence _____

If doing business under a firm name:

Name of firm _____

Business Address _____

Name of Individual _____ Residence _____

B. If a partnership: (Name of all partners)

Name of partner _____ Residence _____

Name of partner _____ Residence _____

C. Corporation:

Full Legal Name: _____

Incorporated in what State _____

Principal Place of Business _____

Place of Business in Massachusetts _____

President _____ Treasurer _____

Secretary _____

D. **If a foreign corporation**, are you registered to do business in Massachusetts?

Yes [ ] NO [ ]

If selected for this work you are required under M.G.L. c30 §39L to obtain from the Secretary of State, Foreign Corporation Section, State House, Boston, MA, a certificate stating that your corporation is registered; and furnish said certificate to the City of Marlborough as the Awarding Authority prior to execution of a contract.

2. Furnish the following information regarding the Surety Company to be used by Bidder:

Full Legal Name _____

State of Incorporation _____

Principal Place of Business _____
Licensed to do Business in Massachusetts: Yes [ ] No [ ]

Name & Contact Number of local agent:

_____

STATEMENT OF BIDDER'S QUALIFICATIONS
(to be completed for contracts not requiring MassDOT pre-qualification)

(All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, add separate sheets for further details.)

1. Name of Bidder _____

2. Permanent Main Office Address _____

   Street and No. _____

   Owners or Town_____

   State and Zip Code _____

3. When Organized: _____

4. When Incorporated: _____

5. How many years have you been engaged in the contracting business under your present firm name? _____

6. General character of work performed by your company:

   _____

7. Have you ever failed to compete any work awarded to you: Yes [ ] No [ ]
   If so, where and why:

   _____

8. Have you ever defaulted on a contract? Yes [ ] No [ ]

9. Have the principal Owners of your company ever failed to complete a contract or been defaulted while engaged in a similar type of business under a different name or different business entity?

   If so, attach a separate statement describing the situation in full.

10. Will you, if requested, furnish a detailed financial statement and any other such information to the Awarding Authority?

    Yes [ ] No [ ]

11. List the more important work completed by your company within the past ten years, stating the approximate cost for each and the month and year completed.

_____

_____

_____

_____

12. List your major equipment available for this contract:

_____

_____

_____

_____

13. List your experience in construction work similar in scope and importance to this project:

_____

_____

_____

_____

14. List your contracts on hand, showing gross amount of each contract and the approximate anticipated date of completion.

_____

_____

_____

_____

15. The undersigned hereby authorizes any person, firm or corporation to furnish any information requested by the Awarding Authority in verification of the statements contained in this Statement of Bidder's Experience.

Dated this _____ day of _____, 20____.

_____
(Name of Bidder)

By: _____
(Signature)

_____
(Title)

SEAL

_____
(Notary Public)

_____
(My Commission Expires)

FORM FOR GENERAL BID

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned

_____, as Principals, and
(insert name of bidder)

_____, As Surety, are hereby
(insert name of surety)

held and firmly bound unto the City of Marlborough, MA in the sum of $_____as liquidated damages for payment of which, well and truly to be made, we hereby jointly and severally bid ourselves, our heirs, executors, administrators, successors and assigns.

The condition of this obligation is such that whereas the Principal has submitted to the City of Marlborough, MA a certain Bid attached hereto and hereby made a part hereof, to enter into a contract in writing hereinafter referred to as the "AGREEMENT" and/or "Contract," for the **Simarano Drive Project - Contract ED 2014-21.**

NOW THEREFORE,

(a) If said bid shall be rejected or withdrawn as provided in the INFORMATION FOR BIDDERS attached hereto or, in the alternative,

(b) If said bid shall be accepted and the Principal shall duly execute and deliver the form of AGREEMENT attached hereto and shall furnish the specified bonds for the faithful performance of the AGREEMENT and/or Contract and for the payments for labor and materials, furnished for the performance of the AGREEMENT and/or Contract,

then this obligating shall be void, otherwise it shall remain in full force and effect; it being expressly understood and agreed that he liability of the Surety for any and all claims hereunder in no event shall exceed the amount of this obligations.

The Surety, for value received, hereby agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extensions of the time within which said bid may be accepted, and said Surety does hereby waive notice of any such extensions.

IN WITNESS WHEREOF, the parties hereto have duly executed this bond on the _____ day of _____, 20___

_____
(Name of Principal)

(SEAL)

By: _____

_____
(Name of Surety)

(SEAL)

By: _____

Sealed and delivered in the presence of

_____

CITY OF MARLBOROUGH
MARLBOROUGH, MASSACHUSETTS 01752-3812

REQUIRED CERTIFICATIONS

CERTIFICATE OF COMPLIANCE WITH STATE TAX LAWS AND WITH UNEMPLOYMENT COMPENSATION CONTRIBUTION REQUIREMENTS

Pursuant to M.G.L. Chapter 62C, §49A and M.G.L. Chapter 151A, §19A, I,

_____

authorized signatory for _____

whose principal place of business is at:

_____

do hereby certify under penalties of perjury that the above business organization has filed all state tax returns, paid all taxes as required by law is in compliance with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholdings and remitting child support and has complied with all state laws pertaining to contributions to the unemployment compensation fund and to payments in lieu of contributions.

The Business Organization Social Security Number or Federal Identification Number is:

_____

Signed under the penalties of perjury the _____ day of 2014.

Signature: _____

Name and Title: _____

Form Of Owner/Contractor Agreement

CITY OF MARLBOROUGH
MARLBOROUGH, MASSACHUSETTS
01752-3812

PUBLIC WORKS CONSTRUCTION
CHAPTER 30, SECTION 39M

AGREEMENT
AND
CONTRACT DOCUMENTS

BETWEEN the Owner: **City of Marlborough**
140 Main Street
Marlborough, MA 01752-3812

and the Contractor:

The Project is: **Simarano Drive – Contract ED 2014-21**

The Designer is: **Vanasse Hangen Brustlin, Inc.**
Union Station, Suite 219
2 Washington Square
Worcester, MA 01604

[] City Clerk [] Contractor [] Legal /CPO [] Department [] Auditor

CITY OF MARLBOROUGH

OWNER-CONTRACTOR AGREEMENT

This agreement made on this ___ day of _____, 2014 by and between the City of Marlborough as the awarding authority, a municipal corporation within said County of Middlesex and having a usual place of business at 140 Main Street, Marlborough, MA 01752, (hereinafter called the "City"), as represented by the MAYOR acting for and in behalf of the City of Marlborough who signs these presents in his official capacity, and incurs no liability in his individual capacity and _____, a corporation, partnership, individual organized under the laws of _____ and having a usual place of business at _____ (hereinafter called the "Contractor").

W I T N E S S E T H, that the City and the Contractor, for the Consideration hereinunder named, agree as follows:

ARTICLE 1. SCOPE OF WORK: The Contractor shall, pursuant to this Agreement, perform all Work required by the Contract Documents for the Simarano Drive Project, Contract ED 2014-21 (hereinafter called the "Project") in the City of Marlborough, Massachusetts, and to accomplish any and all work incidental thereto in accordance with the plans and specifications prepared by Vanasee Hangen Brustlin, Inc. dated June 19, 2014 and addenda numbers ____ to____ attached hereto as prepared by the City.

ARTICLE 2. TIME FOR COMPLETION/LIQUIDATED DAMAGES:

2.1 Time is of the essence for this Agreement. The Contractor shall commence work under this Contract on the date specified in the written "Notice to Proceed" and shall bring the Work to Substantial Completion within **Two Hundred Ten (210) calendar days** of said date.

2.2 Liquidated damages, but not as penalty, will be assessed at a rate of Five Hundred Dollars ($500.00) per calendar day beyond the date indicated in the event of a breach of contract.

ARTICLE 3. CONTRACT SUM: The City shall pay the Contractor for the performance of the Work, subject to additions and deductions by Change Order, of the Contract Sum of:

_____ Dollars ($_____)
CONTRACT SUM IN WORDS

Unit prices are referenced in the Form for General Bid, Section C per the Schedule of Unit Pricing Estimate Form(s), which are incorporated and attached hereto**.**

ARTICLE 4. The following Alternates have been accepted and their costs are included in the Contract Sum stated in Article 3 of this Agreement: Alternate(s) _____ and _____.

ARTICLE 5. NOTICE:

5.1 Wherever in this Agreement the Contractor is to give or receive a notice, ***(_____)*** shall be the Contractor's agent for such purpose. ***name to be inserted***

5.2 Wherever in the Contract Documents the City is to give or receive a notice, **Evan Pilachowski, P.E. City Engineer, Department of Public Works, 135 Neil Street, Marlborough, MA 01752** shall be the City's agent for such purpose.

ARTICLE 6. CONTRACTING OFFICERS (MGL c. 43, §29 & c. 44, §31C): Wherever used in this Agreement, the term "Contracting Officers" shall mean the City Officials so designated below, or the individual duly appointed by him/her for the performance of any of his/her functions or responsibilities under this Contract. The work performed hereunder shall be carried out under the direction and subject to the approval and acceptance of the Mayor, Department Head and City Auditor (hereinafter called the Contracting Officers).

ARTICLE 7. THE CONTRACT DOCUMENTS:

7.1 The following, together with this Agreement, form the Contract and all are as fully a part of the contract as if attached to this Agreement or repeated herein (hereinafter collectively referred to as "the Contract Documents"): Advertisement, Notice to Contractors; Instructions to Bidders, Bidding Documents; Contract Forms; General Conditions of the Contract; Specifications, Drawings, Addenda; Special Conditions, if any; Supplementary Conditions, if any, and Appendices as enumerated in the Table of Contents, the drawings as enumerated in the List of Contract Drawings, and all Modifications issued after execution of the Contract. Terms used in this Agreement which are defined in the General Conditions of Contract shall have the meanings designated in those Conditions.

7.2 The Contract Documents are to be read collectively and complementary to one another; any requirement under one shall be as binding as if required by all. In the event of any conflict or inconsistency between the provisions of this Agreement and any of the other Contract Documents, the provisions of this Agreement shall prevail. In the event of any conflict or inconsistency between this Agreement, the Contract Documents and any applicable state law, the applicable statutory provisions shall prevail.

ARTICLE 8. CERTIFICATIONS: The Contractor shall certify prior to executing this Agreement, Tax Compliance pursuant to M.G.L. c. 62C, §49A, as amended, and payment of Unemployment Contributions pursuant to M.G.L. c. 151A, §19A, as amended.

Article 9. Worker Documentation Certification: In accordance with MGL c. 149, § 19C, the undersigned further certifies under the penalties of perjury that the Contractor shall not knowingly use undocumented workers in connection with the performance of this Agreement; that pursuant to federal requirements, the Contractor shall verify the immigration status of all workers assigned to such contract without engaging in unlawful discrimination; and that it shall not knowingly or recklessly alter, falsify, or accept altered or falsified documents from any such worker(s). The Contractor understands and agrees that breach of any of these terms during the contract period may be regarded as a material breach, subjecting the Contractor to sanctions, including but not limited to monetary penalties, withholding of payments, contract suspension or termination.

Article 10. Conflict of Interest: The Contractor warrants, that he/she or his/her employees, agents, officers, directors or trustees have not offered or attempted to offer anything of value to any employee of the City in connection with the award of the Contract. The Contractor further warrants, that (1) presently, there is no financial interest and shall not acquire any such interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this Agreement or which would violate M.G.L. c.268A, as amended; (2) in the performance of the Contract, no person having any such interest shall be employed by the Contractor or engaged as a subcontractor by the contractor; and (3) no partner or employee of the firm is related by blood or marriage to any Board Member or employee of the Awarding Authority. Violation of this Article shall be material breach of this Agreement, subjecting the Contractor to sanctions, including but not limited to withholding payments or termination without regard to any enforcement activities undertaken or completed by any enforcement agency.

Article 11. Governing Law: This Agreement shall be governed by, construed, and enforced in accordance with the laws of the Commonwealth of Massachusetts.

Article 12. Validation: This Agreement will not be valid until signed by the Mayor.

IN WITNESS WHEREOF, the Contractor and the City have caused this instrument to be executed under seal on the day and year first above written.

FOR THE CONTRACTOR
BY:

_____
By: _____
Title: _____
Date: _____

[This name for the contractor should match the name on the Certificate of Vote form, if corporation.]

ATTEST:

_____
By: _____
Title: _____

APPROVED AS TO FORM BY LEGAL COUNSEL:

_____
By: Donald V. Rider, Jr.
Title: City Solicitor

_____
By: Cynthia Panagore Griffin
Title: Assistant City Solicitor

FOR THE CITY OF MARLBOROUGH
BY:

_____
By: Arthur G. Vigeant
Title: Mayor
Date: _____

ATTEST:

_____
By: Lisa M. Thomas/Steven W. Kerrigan
Title: City Clerk/Asst. City Clerk

DEPARTMENT HEAD:

_____
By: John L. Ghiloni
Title: Commissioner of Public Works

CERTIFICATION PURSUANT TO CHAPTER 44, § 31C AS TO SUFFICIENCY OF FUNDS AND AUTHORIZATION FOR MAYOR TO EXECUTE CONTRACT:

_____
By: Diane Smith
Title: City Auditor
Purchase Req./P.O.#:_____

CERTIFICATION AS TO PROCUREMENT LAW:

_____
By: Beverly J. Sleeper, MCPPO
Title: Chief Procurement Officer
Or Designated Procurement Office

Procurement Law: _____
Contract/File #:_____

Form Of Corporate Vote

CERTIFICATE OF VOTE OF AUTHORIZATION

I,_____ , Clerk of _____hereby certify that, at a

meeting of the Board of Directors of said Corporation duly held on _____ which date is earlier than the contract to which this certificate is incorporated by reference, at which a quorum was present and voting throughout, the following vote was duly passed and is now in full force and effect:

"Voted: That _____ be and hereby is authorized, directed and (Name of Officer authorized to sign for Corporation)
empowered for, in the name of and on behalf of this corporation, to sign, seal with the corporate seal, execute, acknowledge and deliver other obligations of this Corporation; the execution of any such contract, bond or obligation

by such (Name of Officer) _____ to be valid and binding upon this Corporation for all purposes, and that a certificate of the Clerk of this Corporation setting forth this vote shall be delivered to the Awarding Authority; and that this vote shall remain in full force and effect unless and until the same has been altered, amended or revoked by a subsequent vote of such directors and a certificate of such later vote attested by the Clerk of this Corporation is delivered to the Awarding Authority."

I, further certify that (NAME OF
OFFICER)_____

is the duly-elected (TITLE) _____ of said corporation.

►**Signed:**_____
CLERK-SECRETARY

Place of Business:_____

Date of Contract:_____

AFFIX CORPORATE SEAL

►**Countersignature:**_____
(Name and Title of Officer)

In the event that the Clerk or Secretary is the same person as the Officer authorized to sign that contract or other instrument for the Corporation, this Certificate must be counter signed by another officer of the Corporation.

Form Of Performance Bond

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That we, ……as **Principal**, (hereinafter called Contractor), and …… as **Surety**, (hereinafter called Surety), are held and firmly bound unto the **City of Marlborough**, as **Obligee**, (hereinafter called City), in the sum of ……. dollars ($.....) lawful money of the United States of America, to be paid to the Obligee, for which payments, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the **Contractor** has by a written agreement with the **City** dated …… entered into a Contract with the City for the project of ……. In Marlborough, Massachusetts which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if **Contractor** and all Subcontractors under said contract shall pay for all labor performed or furnished and for all materials used or employed in said contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said contract that may hereafter be made, notice to the surety of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purpose or items set out in, and to be subject to, provisions of Massachusetts General Laws Chapter 30, §39A, and Chapter 149, §29, as amended, then this obligation shall become null and void; otherwise it shall remain in full force and virtue.

IN THE EVENT, that the contract is abandoned by the **Contractor**, or in the event that the **City**, under the provisions of said contract terminates the employment of the Contractor or the authority of the Contractor to continue work, said **Surety** hereby further agrees that said **Surety** shall, if requested in writing by the Obligee, take such action as is necessary to complete said contract.

IN WITNESS WHEREOF, we hereunto set our hands and seals this …… Day of ……, 20__.

PRINCIPAL _____ **SURETY** _____

By: _____ By: _____
(Name of Contractor) Attorney-in-Fact

Attest: _____ Attest: _____

Countersigned Massachusetts Resident Agent –

By: ……..

Surety Agent Address

……

Surety Agent Phone Number

……

Form Of Payment Bond

PAYMENT BOND

LABOR AND MATERIALS

KNOW ALL MEN BY THESE PRESENTS:

That we, …… as **Principal**, (hereinafter called Contractor), and ……as **Surety**, (hereinafter called Surety), are held and firmly bound unto the **City of Marlborough**, as **Obligee**, (hereinafter called City), in the sum of ……..… dollars ($.....) lawful money of the United States of America, to be paid to the City, for which payments, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the said **Contractor** has by written agreement dated ……. entered into a Contract with the City for the project of …… in Marlborough Massachusetts which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW THEREFORE, THE CONDITIONS OF THIS OBLIGATION are such that if the **Contractor** and all subcontractors under said contract shall pay for all labor performed or furnished and for all materials used or employed in said contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said contract that may hereafter be made, notice to the **Surety** of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purpose or items set out in, and to be subject to, provisions of Massachusetts General Laws Chapter 30, §39A, and Chapter 149, §29, as amended, then this obligation shall become null and void; otherwise it shall remain in full force and virtue.

IN WITNESS WHEREOF, we hereunto set our hands and seals this …… day of ……, 20__.

PRINCIPAL _____ **SURETY** _____

By: _____ By: _____
(Name of Contractor) Attorney-in-Fact

Attest: _____ Attest: _____

Countersigned Massachusetts Resident Agent –

By: ……..

Surety Agent Address

……

Surety Agent Phone Number

……

Form Of Contractor’s Statement Of Management

(General Contractor)
REQUIRED FOR CONTRACTS WITH A VALUE OF $100,000 OR MORE

SAMPLE

TO BE SUBMITTED ON C.P.A.'S LETTERHEAD

SAMPLE LETTER FROM CPA REGARDING CONTRACTOR ACCOUNTING CONTROLS

DATE:

City of Marlborough – Department of Public Works
Evan Pilachowski, P.E., City Engineer
135 Neil Street
Marlborough MA 01752

RE: Contract ED 2014-21

Dear Mr. Pilachowski,

Please be advised that we have reviewed the Statement of Internal Accounting Controls prepared by the general contractor, NAME OF GENERAL CONTRACTOR, in connection with the above-captioned project. This statement is required under M.G.L. Ch. 30, § 39R. In our opinion, representations of management are consistent with our evolutions of the system of internal accounting controls. In addition, we believe that they are reasonable with respect to transactions as assets in the amount which would be material when measured in relation to the firm's financial statements.

Sincerely,

(C.P.A.)

Form of CPA’s Statement Of Contractor’s Accounting Controls

REQUIRED FOR CONTRACTS WITH A VALUE OF $100,000 OR MORE

SAMPLE

TO BE SUBMITTED ON CONTRACTOR'S LETTERHEAD

SAMPLE LETTER FROM CONTRACTOR REGARDING ACCOUNTING CONTROLS

DATE:

City of Marlborough – Department of Public Works
Evan Pilachowski, P.E., City Engineer
135 Neil Street
Marlborough MA 01752

RE: Contract ED 2014-21

Dear Mr. Pilachowski,

This letter is being submitted pursuant to M.G.L. Ch. 30 §39R(c). Please be advised that our firm has a system of internal accounting controls which assure that:

(1) transactions are executed in accordance with management's general and specific authorization

(2) transactions are recorded as necessary, to permit preparation of financial statements in conformity with generally accepted accounting principles, and to maintain accountability for assets

(3) access to assets is permitted only in accordance with management's general or specific authorization; and

(4) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

Sincerely,

Form Of Contractor’s Equal Employment Certification

FORM OF CONTRACTOR'S EQUAL EMPLOYMENT CERTIFICATION
City of Marlborough
Department of Public Works – Engineering Division

This form must be completed and submitted by the Contractor prior to the signing of the Owner-Contractor Agreement.

This certifies that:

_____
Contractor

_____
Street Address

_____
City/State/Zip Code

1. Intends to use the following listed construction trades in the work under this contract:

_____

_____

_____

_____

_____

_____

2. Will comply with the minority manpower ratio and specific affirmative action steps contained in The Contract Documents; and

3. Will obtain similar certifications from each of its subcontractors and submit to the Owner prior to the award of any subcontract under this contract the subcontractor's certification.

_____
SIGNATURE OF AUTHORIZED REPRESENTATIVE OF CONTRACTOR

_____
NAME AND TITLE

_____
DATE

General Conditions Of Contract

GENERAL CONDITIONS - INDEX

Index

GENERAL CONDITIONS

1. Funding Source

Where contract undertakings of the City are funded, in whole or in part, by any state or federal agency, the City shall have the right to delegate any or all of its rights and responsibilities under this contract to said agencies.

2. Definitions

2.1 Addenda - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, Drawings and Specifications, by additions, deletions, clarifications or corrections.

2.2 Bid - The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

2.3 Bidder - Any person, firm or corporation submitting a Bid for the Work.

2.4 Bonds - Bid, Performance and Payment Bonds, and other instruments of security, furnished by the Contractor and/or its Surety, in accordance with the Contract Documents.

2.5 Change Order - A written order to the Contractor executed by both parties authorizing an addition, deletion or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

2.6 Contract Documents - The Contract, including but not limited to, Notice to Bidders, Instruction to Bidders, Form for General Bid, Certification of Bidder Regarding Equal Employment Opportunity. Form of Owner/Contractor Agreement, Form of Corporate Vote, Performance Bond, Payment Bond, Form of Contractor's Statement of Management, Form of CPA's Statement of Contractor's Accounting Controls, Form of Contractor's Equal Employment Certification, General Conditions, Special Conditions, General Contractor's Guarantee Form, Specifications, Appendices, Change Orders, Plans and Addenda.

2.7 Contract Price - The total moneys payable to the Contractor under the terms of conditions of the Contract Documents.

2.8 Contract Time - The number of calendar days stated in the Contract Documents for the completion of the Work.

2.9 Contractor - The person, firm or corporation with whom the Owner has executed the Agreement.

2.10 Drawings - The part of the Contract Documents which show the characteristics and scope of the work to be performed and which have been prepared or approved by the Engineer.

2.11 Engineer - The City Engineer, designee, individual or firm authorized by the Owner to prepare and review the technical specifications and drawings which the Contractor shall follow in performing the Work.

2.12 Field Order - A written order effecting a change in the Work not involving an adjustment in the Contract Price, or an extension of the Contract Time, issued by the Engineer to the Contractor during construction.

2.13 Notice of Award - The written notice from the Owner to the successful Bidder of acceptance of the Bid.

2.14 Notice to Proceed - Written communication issued by the Owner to the Contractor authorizing it to proceed with the Work and establishing a date of commencement and completion of the Work.

2.15 Owner - A public or quasi-public body or authority, corporation, association, partnership, or individual with whom the Contractor has executed the Agreement, and for whom the Work is to be performed,

2.16 Plans - The Contract Drawings, or exact reproductions thereof, which show the scope, character, dimensions and details of the Work, and which have been prepared or approved by the Engineer.

2.17 Project - The undertaking to be performed as provided in the Contract Documents.

2.18 Project Representative - The duly authorized representative of the Owner.

2.19 Resident Project Engineer - The representative of the Owner who is assigned to the Project site or any part thereof and reports to Project Representative. Resident Project Engineer shall have no authority to bind the Owner to expend funds in excess of appropriated funds, or to modify the specifications, or to suspend or terminate the work.

2.20 Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a subcontractor, manufacturer, supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.

2.21 Specifications - A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards, basis of payment and workmanship.

2.22 Special Conditions or Provisions - Revisions or additions to the General Conditions, Supplemental General Conditions or Specifications applicable to an individual project.

2.23 Subcontractor - An individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part or whole of the Work at the site.

2.24 Substantial Completion - That date as certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

2.25 Supplier - Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

2.26 Work - All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.

3. Contract Plans and Specifications

All plans, specifications and addenda, hereinafter enumerated or referenced in this contract, shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein set fully forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

The Drawings, Specifications and other documents prepared by the City's Engineering Division, and copies thereof furnished to the Contractor, are for the use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor, or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without specific written consent of the Engineer.

4. Additional Instructions and Detail Drawings

The Owner may in its discretion provide the Contractor with additional instructions and detail drawings as necessary to carry out the work included in the contract, and the Contractor shall carry out the work in accordance with the same. The Contractor shall prepare for approval by the Engineer: (a) a schedule, fixing the dates at which special detail drawings will be required, such drawings, if any, to be furnished by the Engineer in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of shop drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment, and the completion of the various parts of the work; each such schedule to be subject to change from time to time in accordance with the progress of the work.

5. Shop or Setting Drawings

The Contractor shall submit promptly to the Engineer three (3) copies of each shop or setting drawing prepared in accordance with the schedule predetermined as aforesaid. After examination of such drawings by the Engineer and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated and shall furnish the Engineer with three (3) corrected copies. The Contractor shall furnish additional copies as requested by the Engineer. Regardless of corrections made in or approval given to such drawings by the Engineer, the Contractor shall nevertheless be responsible for the accuracy of such drawings and for their conformity to the plans and specifications, unless Contractor notifies the Engineer in writing of any deviations at the time such drawings are furnished.

6. Materials, Services and Facilities

6.1 Except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature and all other services and facilities of every nature whatsoever necessary to execute, complete and deliver the work within the specified time.

6.2 Materials and Equipment to be installed as part of the Contract (both or either of which are hereinafter referred to as "Materials") shall be new, unused, of recent manufacture, assembled and used in accordance with best construction practices.

6.3 Materials specified by reference to the number or symbol of a specific standard (such as A.S.T.M. Standard, a Federal Specification or other similar standard), shall comply with requirements of the most recent revision thereof and any amendment or supplement thereto in effect on the date of the Advertisement, except as limited to type, class or grade, or modified in such reference. The standards referred to, except as may be modified by the Contract Documents, shall have full force and effect as though printed therein.

6.4 When requested by the Engineer, the Contractor shall submit Certificates of Compliance from the manufacturer, certifying that the equipment materials comply with the requirements of the specifications or standards. Such certification shall be in the following form:

(sample - on manufacturer's letterhead)
CERTIFICATE OF COMPLIANCE
- (manufactured or fabricated materials) -

Date: _____, 20___

This certifies that _____
(description, kind of material, Model No., etc.)

Furnished to _____
(name of contractor, general or sub)

For use on _____
(project name)

In the amount of _____
(quantity represented)

Identified by _____

Shipped on _____, 20___, Delivered on _____, 20___

Shipped via _____
(method of shipment, Car No., Truck No.)

Meets the requirements of the pertinent project plans, special conditions and specifications of the subject project in all respects. Processing, product testing and inspection control of raw material are in conformance with all applicable specifications, drawings and/or standards of all articles furnished.

All records and documents pertinent to this Certificate and not submitted herewith shall be maintained available by the undersigned for a period of not less than three years from the date of the Certificate.

_____
(name of manufacturer)

By: _____
(name and title of authorized signatory)

7. Contractor's Title to Materials

No materials or supplies for the work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that it has good title to all materials and supplies used by him in the work, free from all liens, claims or encumbrances.

The Contractor shall obtain all necessary rights and licenses to allow the Owner to use the goods and services provided by this Agreement in full compliance with any and all copyright, patent rights or licenses, without requiring additional payment by the Owner.

8. Title to Work

The title to all work completed and in the course of construction and of all material on account of which any payment has been made shall be in the Owner.

9. Inspection and Testing of Materials

All materials and equipment used in the construction of the project shall be subject to inspection and testing by the Owner, or its designee, in accordance with accepted standards to establish conformance with specifications and suitability for uses intended. Nevertheless, said inspection and/or testing, or a lack thereof, shall not relieve the Contractor of its obligations under the terms and conditions of the Contract Documents.

The City shall, at all times and places have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, contract, book of account, and other relevant data and records.

After receiving written notice that certain work or construction is improper, unsafe or defective or in any way fails to conform to the Contract, the Contractor shall forthwith remove such unsafe, improper or defective work and reconstruct the same in a manner satisfactory to the Engineer. Upon failure of the Contractor to remedy the work after being so notified, the Engineer may cause such defective work to be remedied or replaced and the City may deduct the cost thereof from any moneys due or to become due the Contractor.

If any work is covered up without approval of the City, it, must, if requested by the City, be uncovered at the expense of the Contractor. Should the City consider it necessary or advisable, at any time before final acceptance of the entire work, to make an examination of work already completed, by removing or tearing out same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any material respect, the Contractor shall defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of uncovering and replacement shall be covered by an appropriate Change Order adjusting the Contract amount accordingly.

10. Express Warranty

The Contractor guarantees to Owner that all materials incorporated into the work shall be new unless otherwise specified or agreed by the Parties. Contractor also guarantees that all work shall be done in a workmanlike manner, free from defects, and in conformance with any and all specifications contained in the Contract Documents.

The work performed by the Contractor shall conform to the high professional standard of care and practice customarily expected of those engaged in performing comparable work, the personnel furnishing said services shall be qualified and competent to perform adequately the services assigned to them and the recommendations, guidance and performance of such personnel shall reflect such standards of professional knowledge and judgment.

The Contractor shall promptly remedy any defects due to faulty materials or workmanship and pay for any damage to the work resulting there from which shall appear within a period of one year from the date of the City's use or occupancy of the project as a whole. In the event that the project is scheduled to be completed in specific groups or portions, or the City, at its election, accepts groups or portions of the project for use or occupancy, then the warranty period for such group or portion will commence at the time of its completion or acceptance. The City shall give notice of observed defects with reasonable promptness.

Neither partial or final payment, nor any provision in this article, nor partial or entire use or occupancy of the premises by the City shall constitute an acceptance of work not done in accordance with the Contractor or relieve the Contractor of liability in respect to any express warranties, special guarantees, or in respect to faulty materials or workmanship, in accordance with the law of the place of building.

The Contractor warrants good title to all materials, supplies and equipment incorporated in the work and agrees to deliver the premises together with all improvements thereon free from any claim, liens, or charges, and agrees further that neither he nor any other person, firm or corporation shall have any right to a lien upon the premises or anything appurtenant thereof.

11. Maintenance and Guarantee

The Contractor guarantees that all work performed under this contract shall meet fully all requirements thereof as to quality of workmanship and of materials. The Contractor hereby agrees to make at its own expense any repairs or replacements made necessary by defects in materials or workmanship that become evident within one (1) year after the date of the final payment, and to restore to full compliance with the requirements set forth herein any part of the work constructed hereunder, which during said one (1) year period is found by the Owner to be deficient with the respect to any provisions of the specifications. The Contractor shall hold the Owner harmless from claims of any kind arising from damage due to said defects. The Contractor shall make all repairs and replacements promptly upon receipt of written orders for same from the Owner. If the Contractor fails to make the repairs and replacements promptly and within ten (10) days from the date of giving or mailing such notice, the Owner may do the work

and the Contractor shall be liable to the owner for the full cost thereof. This one (1) year guarantee shall not limit any express guaranty or warranty provided elsewhere in the Contract.

Guarantees and warranties required by the Specifications must be delivered to the Engineer before final payment to the Contractor may be made. The failure to deliver a required guarantee or warranty shall constitute a failure to fully complete the Work in accordance with the Contract Documents.

The Owner will discharge or release the performance bond after the expiration of one year from the time of completion provided that no claim filed under said bond is pending, and provided further, that no such bond shall be discharged or released prior to the expiration of all special guarantees provided for in the Specifications in accordance with MGL c.30, §30, as amended.

12. "Or Equal" Clause

Whenever a material, article or piece of equipment is identified on the plans or in the specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and, any materials, article or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design shall be considered equally acceptable provided the material, article or equipment so proposed is, in the opinion of the Engineer, of equal substance and function. It shall not be purchased or installed by the Contractor without the Engineer's prior written approval. Notwithstanding any provision to the contrary, the requirements of MGL c. 30, § 39M(a) are hereby incorporated and made a part of this Agreement.

The Contractor warrants to the City that all materials and equipment furnished under the Contract will be new unless otherwise specified, and that all work will be of good quality, free from faults and defects, and in conformance with the Contract. Where the materials, equipment, articles or workmanship are referred to in the Technical Specification as “equal to” any particular standard, the City shall decide the question of equality. Before any material is incorporated into the work under this Contract, the Contractor may be required to furnish, without expense to the City, a complete statement attesting to the origin, composition and manufacture of any or all materials proposed to be used in the construction of the work, together with samples, which samples may be subjected to the tests required by the City to determine the quality and fitness of the material. In any event, all materials shall meet the Massachusetts Highway Standard Specifications previously referenced.

13. Surveys, Permits and Regulations

Unless otherwise expressly provided for in the specifications, the Owner shall furnish to the Contractor all surveys necessary for the execution of the work. The Owner, however, does not warrantee or guarantee the accuracy or completeness of said surveys. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner and shall at once report to the Engineer errors, inconsistencies or

omissions discovered. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Engineer, the Contractor shall assume responsibility for such performance and shall bear the costs attributable for correction. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported to the Engineer at once.

The Contractor shall procure and pay for all permits, licenses and approvals necessary for the execution of this contract as provided in Article 12 of the Instructions to Bidders, and shall comply with Massachusetts General Laws and the Owner's requirements as provided in Section 9.4 and 9.5 of the Instructions to Bidders, and Article 28 below with respect to bonding and other insurance requirements.

The Contractor shall thoroughly familiarize himself with the standard licensing requirements of the City of Marlborough.

The Contractor shall comply with all laws, ordinances, rules, orders and regulations relating to performance of the work, the protection of adjacent property and the maintenance of passageways, guard fences or other protective facilities. It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contract shall promptly notify the Engineer in writing, and necessary changes shall be accomplished by appropriate modification. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes and rules and regulations without such notice to the Engineer, the contractor shall assume full responsibility for such Work and shall bear the costs attributable.

The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on the performance of the Work.

14. Contractor's Obligations

The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them, and whenever the Owner shall notify the Contractor, in writing, that any workers is, in its opinion, incompetent, unfaithful, disorderly, or otherwise unsatisfactory, such employee shall be discharged from the Work and shall not again be employed on the Project except with the consent of the Owner.

The Contractor shall, in good and workmanlike manner, perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, as are necessary and/or proper to perform and complete all the work required by this Contract, within the time herein specified, in accordance with the provisions of this Contract and said specifications and in accordance with the plans and drawings covered by this

Contract any and all supplemental plans and drawings, and in accordance with the directions of the Engineer as may be given from time to time during the progress of the work. Contractor shall furnish, erect, maintain and remove such facilities, equipment, material and temporary works as may be required.

The Contractor shall be responsible for the proper fitting of all Work and the coordination of the operations of all trades, Subcontractors, or material, men engaged upon the Work. All necessary cutting, coring, drilling, grouting, and patching required to fit together the several parts of the Work shall be done by the Contractor, except as may be specifically noted otherwise under any particular section of the Specifications. The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors, and their agents and employees, and other persons performing portions of the Work. The Contractor shall be responsible for inspection of portions of the Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work. The Contractor shall do engineering required for establishing grades, lines, levels, dimensions, layouts, and reference points for the trades; shall be responsible for maintaining bench marks and other survey marks; and shall replace any bench marks or survey marks which have been disturbed or destroyed.

The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements and limitations of the Contract and specifications, and shall perform, carry on and complete the entire work to the satisfaction of the Engineer and the Owner.

Attention is directed to the provisions of Article 32 of Mass. Standard Specifications relating to the rights of public service corporations and municipal departments to enter the site of the improvements and to alter, replace and/or install facilities at some time when the Contractor will be prosecuting other required work contiguous thereto. The Contractor shall cooperate fully with requirements under said Article.

The Contractor's attention is directed to the fact that all applicable State Laws, Municipal Ordinances and Rules and Regulations of all authorities having jurisdiction shall apply to the Contract throughout, and they will deem to be included in the Contract the same as though herein written out in full.

15. Site Protection and Weather Conditions

The Contractor shall take precautions during the execution of work involving demolition not to disturb or damage any existing structures, landscaping, walks, roads, or other items scheduled to remain. The Contractor shall restore any damaged items to original condition and as directed by the Engineer. The Contract shall provide and erect acceptable barricades, fences, signs and other traffic devices to protect the work from traffic and the public as reasonably necessary and as required by applicable law, code or regulation.

In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer with the Owner's approval shall direct, the Contractor shall, and shall cause its

subcontractors to, protect carefully all work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or materials have been damaged or injured by reason of failure on the part of the Contractor or any of its subcontractors to so protect such work, said materials shall be removed and replaced at the expense of the Contractor.

16. Protection of Work and Property - Emergency

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this Contract, and shall at all times safely guard and protect its own work, and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury unless such be caused directly by errors contained in the Contract or by the Owner, or its duly authorized representatives.

Special care shall be exercised to prevent any disturbance to and protect such underground public service structures and facilities as may be near any work to be done by the Contractor. In addition, care shall be taken to keep heavy equipment and miscellaneous machinery off any private property. Any damages incurred by private homeowners as a result of this construction shall be repaired at the expense of the Contractor.

In case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor is allowed to act, without previous instructions from the Engineer, in a diligent manner to prevent said loss or injury. Contractor shall immediately notify the Engineer and Owner in writing thereafter, and shall promptly submit any resulting claim for extra work to the Engineer.

Where the Contractor has not taken action but has notified the Engineer of an emergency threatening loss or injury to persons or property, or damage to the work or any adjoining property, it shall act as instructed or authorized by the Engineer.

The amount of extra payment claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Paragraph 20 below.

17. Inspection

The authorized representatives and agents of the Owner and/or the Commonwealth, shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials and other relevant data and records.

Unless otherwise required by the Contract Documents, or directed in writing by the Engineer, Work shall be done during regular working hours of 7:00 AM and 3:30 PM, Monday through Friday. However, if the Contractor desires to carry on the Work outside of regular working hours or on Saturdays, Sundays, or Massachusetts holidays, it shall allow ample time to enable satisfactory arrangements to be made for inspecting Work in progress and shall bear the costs of such inspection. The Owner shall bill the Contractor directly for such costs. Work done outside of regular working hours without the consent or knowledge of the Engineer, shall be subject to additional inspection and testing as directed by the Engineer. The cost of this

inspection and testing shall be paid by the Contractor whether the Work is found to be acceptable or not.

If any work is covered up without approval of the Engineer, it must, if requested by the Owner, be uncovered at the expense of the Contractor. If such work is found to be defective in any material respect, the Contractor shall defray all expenses of such examination and of satisfactory reconstruction.

18. Reports, Records and Data

The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, OSHA cards, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this Contract. All records shall be retained by the Contractor for a period of seven years from completion of the work.

All documents produced pursuant to this Agreement shall be the property of the Owner.

All information required from the Owner, or from others at the expense of the Owner, in the performance of this Agreement shall be and remain the property of the Owner. This includes, but is not limited to, all records, data files, computer records, work sheets, deliverable products (complete and incomplete) and all other types of information prepared or acquired by the Contractor in the performance of this Agreement. The requirements of MGL c. 30, § 39R are hereby incorporated and made a part of this Agreement.

19. Superintendence by Contractor

At the site of the work, the Contractor shall employ a construction superintendent or foreman who shall have full authority to act for the Contractor, and shall be acceptable to the Engineer and Owner, and shall be a person anticipated to be continued in that capacity for the duration of the Agreement. The requirements of MGL c. 30, §§39I and 39N are hereby incorporated and made a part of this Agreement.

20. Changes in Work/Extra Work/Limits of Work

20.1 The Contractor shall make no changes in the work without prior written approval of the Owner, however, the Owner may at any time by written order, and without notice to any sureties, require the performance of such extra work or changes in the work as may be found necessary or desirable. No payment for extra work of any kind will be allowed unless expressly approved and authorized by the City in writing through a signed Change Order. Limits of work and descriptive notes on contract drawings are approximate and are only intended to generally describe the area of work required to achieve the correct improvements sought under this Contract. The requirements of MGL c.30, §§39N and 39O are hereby incorporated and made a part of this Agreement.

20.2 The Engineer may authorize minor changes or alterations in the work which do not involve any extra cost or expense, and which are not inconsistent with the overall intent

of the Contract Documents. If the Contractor determines that any such minor change or alteration so authorized by the Engineer entitles Contractor to an increase in the contract price, the Contractor shall be required to obtain prior written approval from the Owner as per paragraph 20.1 above.

20.3 Any Change Order or minor change in the Work must be counter-signed by the Owner or its authorized agent to be effective. All Change Orders will be authorized in accordance with M.G.L. c.44, §31C, as amended.

20.4 The Contractor shall perform all work as directed by Engineer, and if the Engineer determines that certain work for which the Contractor has requested a change order does not represent a change in the Contract, or if the Contractor and the Owner or Engineer cannot agree to the amount of compensation for a change order, the Contractor shall perform said work under protest and must follow the notice requirements and maintain records required by subparagraph 20.8.3.

20.5 The Contractor's attention is directed to M.G.L. Chapter 30, §§ 39I, 39J, 39N, 39O and 39P, as amended, the provisions of which apply to this Contract.

20.6 **Timely Decision By Owner M.G.L. C.30 §39P**

Whenever this Contract requires the Owner or its Engineer to make a decision during construction of the Project, on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, that decision shall be made promptly and, in any event, no later than thirty (30) days after receipt of a written submission for such decision by the Contractor; but if such decision requires extended investigation and study, the Owner or the Engineer shall, within thirty (30) days after the receipt of the submission, give the Contractor written notice of the reasons why the decision cannot be made within the thirty day period and the date by which the decision will be made as required by **M.G.L. c.30 §39P**, as amended.

20.7 ***Deviations From Plans & Specifications M.G.L. C.30 §I***

The Contractor having a contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public works for the commonwealth, or of any political subdivision thereof, shall perform all the work required by such contract in conformity with the plans and specifications contained therein. No willful and substantial deviation from said plans and specifications shall be made unless authorized in writing by the awarding authority or by the engineer or architect in charge of the work who is duly authorized by the awarding authority to approve such deviations. In order to avoid delays in the prosecution of the work required by such contract such deviation from the plans or specifications may be authorized by a written order of the awarding authority or such engineer so authorized to approve such deviation. Within thirty (30) days thereafter, such written order shall be confirmed by a certificate of the awarding authority stating: (1) If such deviation involves any substitution or elimination of materials, fixtures or

equipment, the reasons why such materials, fixtures or equipment were included in the first instance and the reasons for substitution or elimination, and, if the deviation is of any other nature, the reasons for such deviation, giving justification therefor; (2) that the specified deviation does not materially injure the project as a whole; (3) that either the work substituted for the work specified is of the same cost and quality, or that an equitable adjustment has been agreed upon between the contracting agency and the contractor and the amount in dollars of said adjustment; and (4) that the deviation is in the best interest of the contracting authority.
Such certificate shall be signed under the penalties of perjury and shall be a permanent part of the file record of the work contracted for under this Contract. The awarding authority is not obligated to pay for change orders that are not approved in writing in accordance with Subparagraph 20.1 as required by **M.G.L. c.44 §31C and c.30 §39I**, as amended.

20.8 ***Claims***

.1 If the Contractor has any claim or dispute of any nature arising under this Contract, including a claim based on the Owner's failure or refusal to approve a change order request of the Contractor, in full or in part, the Contractor shall submit such claim or dispute to the Engineer in the form of a change order request, for initial review and consideration, subject to further appeal to the Owner's Representative. If the Contractor is not satisfied with the Engineer's decision or, if the Engineer fails to render a decision within thirty (30) days after receiving written notice of such claim or dispute from the Contractor, the Contractor may file a written request for a appeal with the Owner pursuant to Subparagraph 2.

.2 Appeal of an Engineer's decision under Subparagraph 1 must be made directly to the Owner's Representative by certified mail, copy to the Engineer and Owner, within twenty-one (21) calendar days after the date on which the party making the appeal receives the Engineer's written decision or within twenty-one (21) days after the thirty (30) day non-decision period noted in 6.7.1. Failure to appeal within this period will result in the Engineer's decision becoming final and binding upon the Owner and the Contractor.

.3 Pending resolution of the claim or dispute, the Contractor must proceed with the disputed Work, as directed by the Engineer. The Contractor must give written notice to the Owner and the Engineer stating that it is proceeding with the disputed work under protest. Accurate records of the nature and extent of the disputed Work and of the time spent and equipment used on the disputed Work shall be maintained by the superintendent and verified daily by the Project Representative, or the Owner's designee. Failure of the Contractor to maintain such records shall cause the Contractor to forfeit its claim to additional compensation for such disputed work.

.4 Meetings or administrative conferences may be held by the Owner to review the basis of the claim or dispute.

.5 At the conclusion of these proceedings, the Owner shall issue a decision which shall be final under the Contract. The matter may then be appealed to a court of competent jurisdiction.

.6 Requests for administrative conferences by subcontractors must be made by the Contractor; subcontractors cannot make such requests directly.

21. Time for Completion and Liquidated Damages

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion of the work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the "Notice to Proceed." By executing the Contract, the Contractor confirms that the contract time is a reasonable period for performing the Work. The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion with the contract time.

The Contractor shall prosecute the work regularly, diligently, without interruption and at such rate of progress as will ensure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

If the Contractor neglects, fails or refuses to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a partial consideration for the awarding of this Contract, to pay to the Owner the amount of $500.00, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.

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

It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this contract. Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided, further,

that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

(a) To any preference, priority or allocation order duly issued by the Government.

(b) To unforeseeable cause beyond the control and without the fault of negligence of the Contractor, including, but not restricted to, acts of nature, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and severe weather.

(c) To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article.

Provided further, that the Contractor shall within ten (10) days from the beginning of such delay, notify the Owner, in writing, of the causes of the delay, and provide such additional information as the Owner may require, and the Owner shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.

22. Correction of Work

All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Engineer who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture and methods of construction for the purposes for which they are used. Should they fail to meet the Engineer's approval they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the Contractor at its own expense. Rejected materials shall immediately be removed from the site. If, in the opinion of the Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the payment to the Contractor hereunder shall be reduced by such amount as in the judgment of the Engineer shall be equitable.

23. Subsurface Conditions Found Different

Should the Contractor encounter subsurface and/or latent conditions at the site materially differing from those shown on the plans or indicated in the specifications, Contractor shall, prior to disturbing such conditions, immediately provide written notice to the Engineer of such conditions. The Engineer shall thereupon promptly investigate the conditions, and if it is determined that such conditions materially differ from those shown on the plans or indicated in the specifications, the Engineer will at once make such changes in the plans and/or specifications as may be necessary. Any increase or decrease of cost resulting from such changes shall be adjusted in the manner provided in Paragraph 20 of these General Conditions. Notwithstanding any provision to the contrary, the requirements of MGL c. 30, § 39N are hereby incorporated and made a part of this Agreement.

24. Right of Owner to Terminate Contract

The Owner may terminate this Contract by providing the Contractor and the Surety with ten (10) days written notice specifying the reasons for termination, including but not limited to those set forth below:

(a) Violation of any of the provisions of this Contract by the Contractor or any of its subcontractors.

(b) A determination by the Owner that the Contractor has engaged in fraud, waste, mismanagement, misuse of funds, or criminal activity with any funds provided by this Contract.

(c) Failure of the Contractor, for any reason, to fulfill in a timely and proper manner its obligations under this Contract including, but not limited to, compliance with applicable federal, state or local laws or regulations.

If the Owner terminates or suspends this Agreement for one or more of the reasons set forth in (a) through (c), the Contractor shall have a right only to payment for work performed and accepted prior to said termination or suspension, and shall have no right to recover indirect or consequential damages, including but not limited to lost profits.

In the event of any such termination, the Surety shall have the right to take over and perform the Contract. Provided, however, that if the Surety does not commence performance within ten (10) days from the date of the mailing of notice of termination to such Surety, the Owner may take over the work and prosecute the same to completion at the expense of the Contractor, and the Contractor and his Surety shall be liable to the Owner for any excess cost. If the Owner takes over the work, it may take possession of and utilize, at no cost, such equipment, material and temporary works as may be on the site.

Further, the Owner may terminate or suspend this Contract if local, state and/or federal funding are cancelled, revoked, reduced, suspended or terminated.

If the Owner determines that a continuation of work on the project would endanger the life, health, or safety of those working or living at or near the project site, or that immediate action is necessary to protect public funds and/or property, the Owner may suspend work or terminate this Agreement by providing written notice to the Contractor. Should the Owner terminate or suspend this Agreement for any of the reasons set forth herein, the Contractor shall have a right only to payment for work performed and accepted prior to said termination or suspension and shall have no right to recover indirect or consequential damages, including but not limited to lost profits.

25. Payments to Contractor and of Subcontractors

25.1 Payment to the Contractor shall be in accordance with the requirements MGL c. 30, § 39K, which is hereby incorporated and made a part of this Agreement. Before the first Application for Payment, the Contractor shall submit to the Engineer a schedule of values allocated to various portions of the Work, prepared on such form and supported by such data to substantiate its accuracy as the Engineer may require. This schedule, unless objected to by the Engineer, shall be used on a basis for reviewing the Contractor's Applications for Payment. The schedule of values shall contain a separate item for each Section of the Specifications broken down in such form as the Engineer may require. Each item in the schedule of values shall include its proper share of overhead and profit. Once each month, on a date established at the beginning of the Work, the Contractor shall deliver to the Engineer by hand or registered or certified mail with return receipt, an itemized Application for Payment, supported by such data substantiating the Contractor's right to payment as the Engineer may require, and reflecting retainage.

25.2 In preparing estimates, the material delivered on the site and preparatory work done may be taken into consideration.

25.3 Payment shall be contingent upon the Contractor submitting any and all required certified payroll reports to the Owner.

25.4 Payment to subcontractors shall be made in accordance with MGL c.30, §39F, as amended, as noted in this Article.

26. Indemnification

The Contractor hereby indemnifies and shall at all times save and hold harmless the City of Marlborough, and its officers, attorneys, employees, and agents, from and against any and all claims (including workers' compensation and wage claims), demands, suits, actions, liabilities, proceedings, losses, damages, penalties, judgments, and costs and expenses, including without limitation the costs and expenses of litigation, of or by anyone that in any way is caused by, arises out of, or is occasioned by the performance, activities, operations, conducts, negligence, or omissions of the Contractor, including breach, or any of its subcontractors, or the agents or employees of either, regardless of whether or not they are caused in part by a party indemnified hereunder. The existence of insurance shall in no way limit the scope of this indemnification.

The Contractor shall reimburse the Owner for damage to its property caused by the Contractor, its employees, agents, subcontractors or material men, including damages caused by his, its or their use of faulty, defective or unsuitable material or equipment, unless the damage is caused by the Owner's gross negligence or willful misconduct. The Contractor shall bear all losses resulting from the use or storage of explosives and highly inflammable materials and shall save the Owner harmless from all claims for bodily injuries or death to any person and from all claims for property damage for destruction arising out of the use or storage of explosives and highly inflammable materials.

27. Substantial Completion, Final Completion, Acceptance and Final Payment

27.1 Substantial completion shall be that point at which the work has been completed to the extent that the Owner may occupy and make use of the project for which it was intended.

Upon receipt of written notice from the Contractor that the work is substantially complete, the Engineer will promptly make an inspection to determine whether the work is acceptable under the terms of the Contract and whether same is substantially complete. The Engineer will issue a dated certificate which states that the work is substantially complete and accepted under the terms and conditions of the Contract, and a punch list of all items to be completed or corrected. The entire balance due the Contractor, less two percent (2%) retainage plus a retention based on the Engineer's estimate of the fair value of the punch list items, and cost of completing or correcting such items, and the estimated value of claims made relating to the project, shall be due and payable.

The general guarantee period for the work substantially complete shall begin on the date certified by the Engineer.

27.2 Final completion shall be that point at which all work on the project has been completed, all defective work has been corrected, and clean-up of the site and any debris has been accomplished. Unless a certificate of substantial completion has issued, the general guarantee period shall begin upon certification by the Engineer of final completion. The entire balance due the Contractor, less the estimated value of claims made relating to the project to the extent allowed by law, shall be due and payable within 35 days of the Contractor's written acceptance of the final estimate as required by MGL c. 30, § 39G.

27.3 The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability by the Contractor. No payment, however, final or otherwise, shall operate to release the Contractor or its Sureties from any obligations under this Contract, the performance and payment bonds, or any express or implied warranties. Prior to any final payment the contractor or subcontractor must submit all certified payrolls to the Owner and supply a lien release the states that all subcontractors working on this project have been paid for their work.

28. Insurance

The Contractor shall not commence work under this Contract until it has obtained and submitted proof to the Owner of all the insurance required under this paragraph and such insurance has been approved by the Owner. The form of proof shall be a Certificate furnished to the Owner within ten (10) days of receipt of notice of award of contract but no later than the time at which the Contractor executes the Contract.

(a) Workmen's Compensation Insurance:

The Contractor shall procure and shall maintain during the life of this Contract

Workmen's Compensation Insurance as required by applicable federal, state or local law, for all of its employees and, in case of any such work sublet, the Contractor shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees as required by law in the following limits: Cover A –Statutory and Coverage B Employer's Liability $500,000 each accident/$500,000 disease per employee/$500,000.disease policy.

(b) Contractor's Commercial General Liability, Contractor's Public Liability and Property Damage Insurance

The Contractor shall procure and shall maintain during the contract term, Commercial General Liability coverage with respect to the operations performed by any employee, Subcontractor, or supplier, bodily injury and property damage insurance in the amount of $1,000,000 per occurrence and $3,000,000 in the general aggregate, including products and completed operations, personal and advertising injury. This policy shall include coverage relating to explosion, collapse, and underground (XCU) property damage.

The Contractor shall procure and shall maintain during the contract term, on a per occurrence basis separate Owner's and Contractor's Public/Protective Liability Insurance in the name of the Owner at the same limits listed above.

The completed operations coverage shall be maintained for a period of two (2) years after Substantial Completion as defined in Subparagraph 27.1.
The property damage coverage shall include Special Perils coverage against loss or damage by fire and against loss or damage covered by the special perils insurance endorsement on all work in this Contract in an amount equal to at least 80% of the Contract Sum. This policy shall indicate if Stored Materials coverage is provided to include materials or equipment delivered at the site of the Work (or at some location agreed to in writing. The policy or policies shall specifically state that they are for the benefit of the Owner, the Contractor, and all persons furnishing labor or labor and materials for the Work, as their interests may appear. The Special Perils coverage shall include any costs for additional work performed by the Engineer or any consultant as the result of a loss experienced during the life of this Contract.

(c) Vehicle Liability Insurance:

The Contractor shall procure and shall maintain during the contract term, Vehicle Liability Insurance with respect to vehicle operations by any employee, including coverage of owned, non-owned, and hired vehicles, in the amount of $1,000,000 C.S.L.

(d) Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance:

The Contractor shall either (1) require each of its Subcontractors to procure and to maintain, during its subcontract term, occurrence basis Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance in the amount of $1,000,000, or (2) insure the activities of such subcontractors, in addition to its policy specified in subparagraph (b) hereof.

(e) Excess/Umbrella Liability Coverage

Umbrella or Excess Liability coverage following form of underlying General and Vehicle Liability coverage up to $5,000,000 as required C.S.L.

(f) Proof of Insurance:

The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate shall not be canceled or reduced, except after thirty (30) days written notice has been received by the Owner."

(g) City of Marlborough as Additional Insured and Certificate Holder

The Contractor shall have the "City of Marlborough" named as an additional insured for this project on the policy, which shall be evidenced by the Certificate submitted to the Owner. The Certificate holder shall read exactly as follows: "City of Marlborough c/o Department of Public Works, Engineering Division, 135 Neil Street, Marlborough, MA 01752."

29. Contract Security, Performance and Payment Bonds

29.1 The Contractor shall furnish to the Owner, at the time of its execution of the Contract, a Performance Bond in an amount at least equal to one hundred percent (100 %) of the total contract price as security for the faithful performance of this Contract. Such bonds shall be in a form, and with a surety company approved by the Owner and authorized to do business in the Commonwealth of Massachusetts.

29.2 The Contractor shall furnish to the Owner, at the time of its execution of the Contract, a Payment Bond in an amount not less than one hundred percent (100 %) of the total contract price, as security for the payment of all persons performing labor on the project under this Contract, and furnishing materials in connection with this Contract. Such bond shall be in a form, and with a surety company approved by the Owner and authorized to do business in the Commonwealth of Massachusetts.

29.3 It is expressly understood and agreed that all sums retained or that may be retained by the City under any of the provisions of this Contract are solely for the benefit of the City and

that the security required by MGL Ch. 149, sec. 29, as amended, is furnished exclusively by the bond accompanying the Contract.

29.4 Failure to meet the bond requirements of this section shall be cause to terminate the Contract.

30. Assignments

The Contractor shall not assign or subcontract the whole or any part of this Contract or any moneys due or to become due hereunder without the prior written consent of the Owner. If the Contractor assigns all or any part of any moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that the right of any assignee in and to any moneys due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work required by this Contract.

31. Engineer's Authority

The Engineer will give all orders and directions contemplated under this Contract and specifications relative to the execution of the work. The Engineer shall determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this Contract and shall decide all questions which may arise in relation to said work and the construction thereof. The Engineer's estimates and decisions shall be final and conclusive, except as herein otherwise expressly provided. If any dispute arises between the parties hereto relative to said Contract and/or specifications, the determination of the Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work related to said dispute. The Engineer will decide the meaning and intent of any portion of the specifications and of any plans or drawings.

32. Use of Premises, Removal of Debris, Sanitary Conditions

The Contractor, at its own expense, shall: (1) take every precaution against injuries or damage to property; (2) store its apparatus, materials, supplies and equipment in such orderly fashion at the site as to not unduly interfere with the progress of its work or the work of other contractors; (3) place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work; (4) clean up frequently all refuse, rubbish, scrap materials and debris caused by its operations; (5) before final payment, remove all surplus material, falsework, temporary structures, including foundations thereof, plant of any description and debris of any nature resulting from its operations, and to put the site in neat, orderly condition; (6) effect all cutting, fitting or patching of its work required for conformance with the specifications and, except with consent of the Engineer, not cut or otherwise alter the work of any other contractor; and (7) maintain in a neat, sanitary condition such toilet accommodations for the use of its employees as may be necessary to comply with the State and local Boards of Health, or other bodies having jurisdiction over same.

The Contractor shall remove debris from the site of the work and legally dispose of it at any private or public dump or other facility that the Contractor may choose. The Contractor shall make all arrangements and obtain any approvals necessary for said disposal from the owners or officials in charge of such dumps.

No open fire shall be permitted on site.

Chemical Waste: Chemical waste shall be stored in corrosion resistant containers, removed from the Project site, and disposed of not less frequently than monthly unless directed otherwise. Disposal of chemical waste shall be in accordance with requirements of the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (DEP). Fueling and lubricating of vehicles and equipment shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants to be discarded or burned shall be disposed of in accordance with approved procedures meeting all applicable Federal, State and local regulations. In the event of an oil or hazardous materials spill large enough to violate Federal, State, or applicable local regulations, the Engineer shall be notified immediately. The Contractor shall be responsible for immediately cleaning up any oil or hazardous waste spills resulting from its operations. Any costs incurred in cleaning up any such spills shall be borne by the Contractor.

33. Notice and Service Thereof

Any notice to either party from the other relating to this Agreement shall be in writing and posted, by certified mail, return receipt requested, to the party at the address noted below:

City

Evan Pilachowski, P.E.
Department of Public Works
City of Marlborough
135 Neil Street
Marlborough, MA 01752

Contractor

34. Other Prohibited Interests

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract or any other contract pertaining to the project.

35. Suspension of Work

If the Owner is prevented or enjoined from proceeding with work either before or after the start of construction by reason of any litigation or other reason beyond the control of the Owner, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of the work shall be extended to such reasonable time as the Owner may determine will compensate for time lost by such delay with such determination to be set forth in writing. If the reason for said delay was not beyond the control of the Contractor, the Contractor shall have no right to damages, as set forth herein, or to an extension of time. Notwithstanding any provision to the contrary, the requirements of MGL c. 30, §39O are hereby incorporated and made a part of this Agreement.

36. Access to Records

The Contractor shall maintain accounts and records, including personnel, property and financial records, adequate to identify and account for all costs pertaining to the Contract and such other records as may be deemed necessary by the Owner to ensure proper accounting for all project funds. These records shall be made available for audit purposes to the Owner or any authorized representative, and shall be retained for seven years.

37. Age Discrimination Act of 1975 (for contracts over $2,000)

No person in the United States shall, on the basis of age, be excluded from participation in, be denied the benefits of, or be subjected to discrimination from receiving Federal financial assistance. The Contractor shall comply with the provisions of the Age Discrimination Act of 1975 (42 U.S.C. 6101 et seq.), prohibiting age discrimination in employment.

38. Non-Discrimination

The City of Marlborough is an Equal Opportunity Employer. The Contractor shall not discriminate against any employee or applicant for employment because of race, age, color, religious creed, gender, handicap, sexual orientation, veteran's status or national origin. The Contractor shall take affirmative action to ensure that applicants for employment and employees are treated without regard to their race, age, color, religious creed, gender, handicap, sexual orientation, veteran's status or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth the provision of this non-discrimination clause. The Contractor shall state in all solicitations or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants shall receive consideration for employment without regard to race, age, color, religious creed, gender, handicap, sexual orientation, veteran's status or national origin. The Contractor shall incorporate the foregoing requirements of this paragraph in all contracts for work to be performed in accordance with this Contract, and shall require all of its subcontractors to incorporate such

requirements in all subcontracts for program work. The City may cancel, terminate or suspend the Contract in whole or in part for any violation of this paragraph.

Equal Employment Opportunity Requirements: The Contractor's EEO Certificate must be signed by the low general bidder and all file subbidders as a condition of Contract validation by the Owner. The Contractor shall provide weekly and quarterly information to the Owner on copies of forms that can be found in Appendix B. The Owner may suspend part of all of any payment due under this Contract until such time as the Contractor or any Subcontractor is able to demonstrate compliance with the terms of the Contract. The Owner may terminate or cancel part or all of the Contract, in accordance with the termination provisions of this Contract, unless the Contractor or Subcontractor is able to demonstrate, within a specified time, compliance with the terms of the Contract.

The Contractor shall send to each labor union or representative or workers with which they have a collective bargaining agreement or other contract or understanding, a notice advertising the said labor union or worker's representatives of the Contractor's commitment under this subsection and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

In the event of noncompliance by the Contractor with the nondiscrimination clauses of this Agreement or with any such rules, regulations, or orders of the Secretary of Labor, the Contract may be canceled, terminated or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contract or federally assisted construction contract procedures authorized in Executive Order 11246, or by rules, regulations, or orders of the Secretary of Labor, as otherwise provided by law.

39. Non Federal Labor-Standards Provisions

The Massachusetts Labor-Standards Provisions, including the provisions concerning maximum hours of work, minimum rates of pay, and overtime compensation, with respect to the categories and classifications of employees hereinafter mentioned are included in this Contract pursuant to the requirements of applicable State or local laws. The limitations, if any, in these Massachusetts Labor-Standards Provisions upon the hours per day, per week or per month which employees engaged on the work covered by this Contract may be required or permitted to work thereon shall not be exceeded.

40. Schedule of Salaries and Wages

The Contractor shall be responsible for complying with prevailing wage rates and health and welfare fund contributions applicable to this Contract as determined by the Commonwealth of Massachusetts, Department of Labor and Workforce Development, Division of Occupational Safety (DOS), under the provisions of MGL, c. 149, §§ 26 - 27D. If the DOS has established a Schedule of prevailing wage rates to be paid to the operators of trucks, vehicles or equipment for this Project, the Contractor is obligated to pay operators at least the prevailing wage rate contained on the Schedule under the provisions of MGL c.149, §§26-27H, as amended. If drivers

of bituminous concrete (asphalt) or ready-mix concrete (cement) are employed by the Contractor, they shall be paid the prevailing wage only while on-site at the public construction project. (Notice January 8, 2004 issued by the Department of Labor's Division of Occupational Safety)

The State prevailing wages, which are incorporated herein by reference, shall be paid under this contract and reported by the submission of certified weekly payrolls to the Owner. The Contractor is responsible for compliance of this paragraph by its subcontractors.

41. Labor Provisions

41.1 In the employment of mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works in the Commonwealth by the Contractor and Subcontractors, preference shall first be given to citizens of the Commonwealth who have been residents of the Commonwealth for at least six months at the commencement of their employment, who are veterans as defined in clause forty-third of MGL c. 4, §. 7, as amended, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally who have been residents of the Commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States, in accord with MGL c. 149, §26. Veterans' preference per MGL c.41, §112.

41.2 The minimum rates of wages to be paid mechanics and apprentices, chauffeurs, teamsters and laborers shall be set forth in the schedule of rates of wages determined by the Commissioner of Labor and Industry as required by MGL c.149, §§26-28, as amended, unless the Federal rates are higher.

41.3 In accordance with MGL c. 149, s 34A, the Contractor shall, before commencing performance of the contract, provide by insurance for the payment of employer's liability compensation and the furnishing of other benefits under M. G. L. c. 152 to all persons to be employed under the contract, and the Contractor shall continue such insurance in full force and effect during the term of the contract. Sufficient proof of compliance with this section must be furnished at the time of execution of this contract. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of the contract and shall operate as an immediate termination thereof. The attention of the Contractor is directed to that portion of G. L. c. 149, s. 34A which provides that whoever violates any of its provisions shall be punished by a fine of not more than one hundred dollars or by imprisonment for six months, or both; and, in addition, any Contractor who violates any provision of this section shall be prohibited from contracting, directly or indirectly, with the Commonwealth or any political subdivision thereof for the construction, alteration, demolition, maintenance or repair of, or addition to, any public works or public building for a period of two years from the date of conviction of said violation.

41.4 The Contractor shall pay to any reserve police officer employed by it the prevailing rate of wage paid to regular police officers, as required by MGL c. 149, s. 34B.

41.5 The Contractor shall provide the Owner with copies of each current permanent OSHA card or temporary OSHA certificate for each employee working on this project with the initial payment request; along with each journeyman's or apprentice certificate for each employee claiming this work category.

41.6 **N**o laborer, workman, mechanic, foreman or inspector working within the Commonwealth of Massachusetts in the employment of the Contractor, Subcontractor or other person doing or contracting to do the whole or part of the Work, shall be required or permitted to work any more than eight hours in any one day, or more than 48 hours in any one week, or more than six days in any one week in full compliance with provisions of **M.G.L. c.149 §34**, as amended, except in cases of emergency.

Every employee on the Work shall lodge, board, and trade where and with whom he/she elects, and the Contractor and any Subcontractor nor his agents or employees shall not directly or indirectly require, as a condition of employment, that an employee lodge, board, or trade at a particular place or with a particular person.

42. Environmental Requirements

The Contractor shall comply, where applicable, with: Protection of Wetlands Laws.

43. "Right To Know" Law

If the Contractor uses or stores toxic or hazardous substances it is subject to MGL c. 111F, §2, the Right to Know Law and regulations promulgated by the Department of Public Heath, 105 CMR 670, the Department of Environmental Protection, 310 CMR 33, and the Department of Labor and Workforce Development, 441 CMR 21, and must post a Workplace Notice obtainable from the Department of Labor and Workforce Development.

As per requirements established by the United States Department of Labor Occupational Safety and Health Administration and in compliance with MGL c. 111F, Right to Know Law, it is required that all Material Safety Data Sheets accompany each initial product shipment where applicable, as well as a copy sent to the Grants Administrator, which will be forwarded to the Right-To-Know Coordinator for the City of Marlborough.

44. Archaeological and Historic Preservation

All items having any apparent historical or archaeological interest which are discovered in the course of any construction activities shall be carefully preserved and reported immediately to the Engineer for determination of appropriate actions to be taken.

The Contractor shall, in the performance of environmental assessments under the National Policy Act, and the Massachusetts Environmental Policy Act, comply with section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470), federal Executive Order

11593, and the Preservation of Archaeological and Historic Data Act of 1966 (17 U.S. C. 469 a-1 et seq.), by (a) consulting with the State Historic Preservation Officer to identify properties listed in or eligible for inclusion in the National Register of Historic Places that are subject to adverse effects (see 36 CFR Part 800.8) by the proposed activity.

45. Interest of Contractor and Employees

The Contractor covenants that it presently has no interest and shall not acquire any interest, direct or indirect, in the study area or any parcels therein or any other interest which would conflict in any manner or degree with the performance of its services hereunder. The Contractor further covenants that in the performance of this contract, no person having any such interest shall be employed.

46. Statement of Management, CPA Statement MGL c.30, §39R (for contracts in excess of $100,000)

For contracts in excess of $100,000 the Contractor, prior to execution of the Contract, shall file a statement of management with the Owner assuring that its system of auditing controls ensures management accountability and protection of assets as required by MGL c. 30, sec. 39R(c).

For such contracts, the Contractor shall file with a Owner, prior to execution of the Contract, a signed statement from a Certified Public Accountant that said CPA has examined the Statement of Management and opines whether the representations of management are consistent with its system of controls and its financial statements as set forth in MGL c. 30, § 39R(c).

The Contractor awarded a contract shall annually file with the Owner during the term of the Contract, a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report.

47. Severability

If any provision of this Agreement is held invalid, the remainder of the Agreement shall not be affected thereby, and all other parts of this Agreement shall nevertheless be in full force and effect.

48. Confidentiality

The Contractor shall protect the privacy of, and respect the confidentiality of information provided by, program participants, consistent with applicable federal and state regulations, and further shall comply with MGL c. 66, sec. 10, regarding access to public records.

49. Executive Orders

The Contractor shall comply with the provisions of M.G.L. c.151B; Executive Order 478 regarding Nondiscrimination, Diversity, Equal Opportunity and Affirmative Action; Executive

Order No. 390 pertaining to minority and women owned business development; Executive Order 481, prohibiting the use of undocumented workers on state contracts (including state-assisted funded contracts); and all regulations promulgated pursuant thereto. The aforementioned law, executive orders, and regulations are incorporated herein by reference and made a part of this Contract as applicable.

50. Compliance with Chapter 370 Acts of 1963

The contractor shall furnish all notices and shall do all work and be responsible for all requirements of Chapter 370 of the Acts of 1963, entitled "An Act Requiring a Contractor Making An Excavation In A Public Way to Give Notice Thereof to Public Utility Companies."

No person shall dig up or make an excavation in a public way for the laying, altering or repairing of a drain water or sewer without obtaining a written permit from the Department of Public Works, Engineer Division City. Notwithstanding any contrary provision of any local ordinance or by-law, no such permit shall, except in case of an emergency, be approved or issued by said division until copies of the notices to public utility companies required by section forty of chapter eighty-two have been filed with said board or officer by the applicant for such permit. Whoever violates any provision of this section shall be punished by a fine of not more than fifty dollars for the first offense and not less than fifty dollars nor more than one hundred dollars for any subsequent offense.

51. Foreign Corporations

Contractors and subcontractors incorporated outside of Massachusetts shall comply with MGL c. 30, sec. 39L and other applicable laws.

52. Applicable Law

This Agreement shall be construed under the laws of the Commonwealth of Massachusetts. The laws of the Commonwealth of Massachusetts ("Commonwealth") shall govern all rights and duties under this Agreement, including without limitation the validity of this Agreement. Any actions arising out of this Agreement shall be brought and maintained in a State or Federal Court in Massachusetts which shall have exclusive jurisdiction thereof. The City may agree to voluntary mediation or arbitration of any contract dispute and will share the costs of such mediation or arbitration. No legal or equitable rights of the parties shall be limited by this paragraph.

53. Asbestos

If this Project requires the containment or removal of asbestos or material containing asbestos, lead or waste containing lead base paint, the Contractor shall ensure that the person or company performing the asbestos or lead related services is licensed pursuant to applicable State laws and regulations.

54. As-Built Plans

The Contractor shall furnish electronic and hard copy "As-Built" plans of the completed Project to the Engineer prior to final acceptance of the Project by the City. To begin this process, the City will supply to the contractor a set of electronic CAD files of the Contract Drawings in a blank as-built format. These drawings will contain all relevant information regarding all approved conditions of the job. They will not, however, contain any horizontal or vertical information for any water, drainage, sewerage or other utilities installed, elevations, design, etc. Any element of the site modified and/or adjusted as part of this project must be noted and the as-built information supplied on the drawings. Ample space and parenthetical blanks will be present for this information. The contractor's engineer shall also locate the curb line, edge of pavement, retaining walls and show and/or label the center line elevations on the as-built drawings.

When the electronic plans supplied to the contractor by the City of Marlborough have been filled in with all appropriate as-built information, the contractor shall submit a set of **preliminary** plans for review by the City. The plans supplied by the contractor or his engineer to the City contain the as-built data as described above. All as-built information supplied by the contractor shall be in **RED** ink and ***ITALICIZED*** so as to signify that it is the final information. There shall also be an indication of this in the legend and a brief explanation. This first set of as-built plans does not have to be certified by an engineer or contain the required signatures. These are for our review only. After review, the City of Marlborough will notify the contractor of any changes or corrections that need to be made. Upon approval, the set of plans will be returned to the Contractor. The contractor will then acquire the necessary certifications and signatures for final submission of the final as-built drawings produced on Mylar.

The contractors engineer shall also provide the following certifications as part of his as-built drawings submittal:

1. I hereby certify that the information shown on this/these plan(s) accurately depicts field conditions based on an as-built survey by (*name of as-built surveyor*) performed on (*date of as-built survey*)
2. I hereby certify that the as-built information shown on this plan is in conformance with the approved site plans dated (date of contract plan).
3. I hereby certify that all sidewalks, handicap wheelchair ramps and driveway aprons conform to the latest standards and requirements of the Massachusetts Access Board, American Disability Act and the Architectural Access Board.

Electronic As-built Drawing Set

The contractor shall also provide this office with a complete electronic as-built drawing set. All as-built files must be compatible with the current version of AutoCAD the City uses and accepts. Check with the City of Marlborough Engineering Department for the latest version accepted. The as-built electronic plans will use the digital base map information provided by the City of Marlborough as the base for all additional information. The City of Marlborough's base maps are

tied to the North American Datum of 1983 (NAD83) and the North American Vertical Datum of 1988 (NAVD88). All features shall be further stored in the Massachusetts State Plane Coordinate System. This will allow integration into the City's Geographic Information System.

The electronic as-built drawing set shall conform to the minimum standards specified in this section. All as-built drawing information shall accurately represent as-built construction and shall be graphically and mathematically correct, i.e. drawing objects shall represent changes in dimensioning during construction. There should be complete consistency between final electronic and hard copy information. The electronic files should allow the City of Marlborough to reproduce hard copies if needed.

Plan and Profile:

1. All as-built information shall be placed on its own layer entitled "AS_BUILT_INFO"

2. Include and attach all detail information generated by automated design software that describe any infrastructure components.

3. Non-referenced images, standard drawings, specifications, and/or blocks shall be bound in the drawing and not attached as an external reference.

4. If registered orthophotography is used as a backdrop, the image and registration file along with directory information, shall be provided.

5. Transportation plans for Signal or Detection systems, Street Lighting, or Roadway Striping/Signing shall each be submitted in individual AutoCAD drawing files.

Plot Layout/Plot Settings:

1. Submit all information required to reproduce a hard copy from the submitted electronic file.

2. Standard pre-installed AutoCAD font and line types shall be used.

Referenced Information

1. If X-refs are used with a drawing, bind all X-refs before submission. The City will not accept drawing with X-refs.

2. Purge all invisible drawing objects before submission.

Drawing Objects (Entities)

1. All as-built infrastructure components shall be conform to the City's layering convention as stated above.

2. Purge all drawings of empty layers and unused blocks, line types, dimension styles, plot styles, text styles, shapes, etc., and make sure all infrastructure components are clean, that is:

1. Ends of arcs, lines and p-lines are snapped end-point to end-point.
2. Remove duplicate objects.
3. Features representing areas (detention ponds, etc.) are composed of closed p-lines are at a minimum a series of valid objects snapped end-to-end with no gaps.

3. All drawing objects required for updating City inventories shall be easily assessable for extraction.

4. All infrastructure components shall be composed of the following valid object types in order to be accepted by the City:

1. Arc.
2. Circle.
3. Dimension.
4. Ellipse (including elliptical arcs).
5. Image.
6. Insert (also known as a Block Reference).
7. Leader.
8. Line.
9. Multiline Text.
10. Point.
11. Polyline.
12. Text.

Ownership:

All electronic files and hard copy maps submitted to the City of Marlborough upon completion of the project will become the sole property of the City of Marlborough. The City gains the right to ownership of all content for any future use. Electronic files will be submitted with full editing privileges allowing any future edits to be made by the City of Marlborough at a later date.

55. Miscellaneous

55.1 Firewood

The Contractor should anticipate that some property owners will wish to obtain a limited amount of firewood from tree removal operations under the Contract. Said property owners shall be given the opportunity to remove said firewood within a reasonable time. If, in the opinion of the Engineer, the wood is not removed within a reasonable time, the Contractor shall be responsible for removing it from the project.

55.2 Blasting

When the use of explosives is necessary for the execution of the work, the Contractor shall take the utmost care not to endanger life and property. Whenever directed, the number and size of the charge shall be reduced. The method of storage and handling of explosive and highly flammable materials shall conform with all state laws and regulations, as well as local requirements.

The Contractor is responsible for establishing pre-construction/blasting conditions which will include a pre-blast survey of all structures within 500 feet of the project limits. Care shall be taken to prevent injury to existing pipes or other structures and property above or below ground. Any damage caused as a result of the Contractor's work shall be the Contractor's responsibility.

Blasting operations are subject to the approval of the City of Marlborough Fire Chief. Explosive materials shall not be stored overnight, on site per the Marlborough Fire Department.

The successful Contractor must provide blasting details at all sites where blasting is to occur. The details are to be staffed by firefighters. No direct payment shall be made by the City to the Contractor for said details, the cost of which shall be included in the appropriate items unless otherwise provided for in the Contract. The Contractor must schedule the detail the day before the blasting operation. The permitting will be in accordance with 527 CMR 13.00, Massachusetts Fire Safety Code.

55.3 Work To Be Done By Others

The NSTAR Service Company, National Grid, Verizon, and Com Cast/AT&T Broadband will, at their own expense, relocate their respective utilities as required.
The above work is expected to be carried out at the same time and in cooperation with the Contractor. No additional compensations will be allowed for any delay or inconvenience caused by these operations or other operations for adjustment, relocation, connection, alteration, to existing or installation of new structure, poles, underground cables and pipes.

55.4 Notice To Utilities

Written notice shall be given by the Contractor to all public service corporations or officials owning of having charge of publicly or privately owned utilities of its intentions to commence operations affecting such utilities as least one week in advance of the commencement of such operations. The Contractor shall file a copy of such notice with the Engineer.

CITY OF MARLBOROUGH

Engineering Division
135 Neil Street
Marlborough, MA 01752

Evan Pilachowski
City Engineer
Phone:(508)624-6910

Marlborough Fire Department
215 Maple Street
Marlborough, MA 01752

Chief James Fortin
Phone:(508)624-6986

Marlborough Police Department
355 Bolton Street
Marlborough, MA 01752

Chief Mark F. Leonard
Phone:(508)485-1212

Marlborough Water & Sewer Dept
135 Neil Street
Marlborough, MA 01752

David Lavallee
General Foreman
Phone:(508)624-6910

Marlborough Forestry Dept
135 Neil Street
Marlborough, MA 01752

Chris White
Tree Warden
Phone:(508)624-6910

ELECTRIC

National Grid
280 Melrose Street
Providence, RI 02907-2152

Bruce Kut
Phone:(508)482-1306

TELEPHONE

Verizon
385 Myles Standish Blvd.
Taunton, MA 02780

Paul Schneider
Phone: (508) 820-3589

GAS

Nstar Gas
175 MacArthur Drive
New Bedford, MA 02740

Steven Owens
Phone: (508)441-5881

CABLE

Comcast
676 Island Pond Road
Manchester, NH 03109

Pam Letizi
Phone: (603)695-1412

AT&T / TCG, c/o Siena Engineering
50 Mall Road – Suite 203
Burlington, MA 01803

David Edgar
Phone: (781)221-8400

RCN
173 Bedford Street
Lexington, MA 02420

Margot Jones
Phone: (781)652-8951

RAILROAD

CSX
310 Cambridge Street
Boston, MA 02114

Leslie Scherr
Phone: (904) 366-3057

OTHER AFFECTED PARTIES ARE:

Vanasse Hangen Brustlin, Inc.
Union Station, Suite 219
2 Washington Square
Worcester, MA

Brian Brosnan, P.E.
Project Manager
Phone:(508) 752-1001

Avalon Bay Communities, Inc.
51 Sleeper Street, Suite 750
Boston, MA 02210

Tony Sanchez
Senior Project Manager
Phone:(617) 654-9575

"DIG SAFE" Call Center 1-888-344-7233

The Contractor's attention is directed to Ch. 502 of the Acts of 1980 as they apply to excavations in general. The Contractor shall be responsible for complying with all aspects of this regulation prior to proceeding with any excavation.
The Contractor must comply with Dig-Safe Laws. Dig-Safe is the Utility Underground Plant Damage Prevention System, 331 Montvale Ave., Woburn, MA 01801, 1.888.344.7233. The Contractor must notify Dig-Safe of contemplated excavation, demolition, or explosive work in public or private ways, and in any utility company right of way or easement, by certified mail, with a copy to Department of Environmental Protection (DEP). This notice must be given at least seventy-two (72) hours prior to the work, but not more than sixty (60) days before the work is to be done. Such notice shall state the name of the street or the route number of the way and an accurate description of the location and nature of the proposed work. Dig-Safe is required to respond to the notice within seventy-two (72) hours of receipt by designating the location of pipes, mains, wires or conduits at the site. The Contractor shall not commence work until Dig-Safe has responded. The work shall be performed in such manner and with reasonable precautions taken to avoid damage to utilities under the surface at the work location. The Contractor shall provide the Superintendent with current Dig-Safe regulations, and a copy of **M.G.L. c.82 §40**. Any costs related to the services performed by Dig-Safe shall be borne by the Contractor.

The Contractor is advised to verify the locations of existing overhead and subsurface utilities in the vicinity of this project with the local utility companies.
Before the Contractor begins any work or operation which might damage any subsurface structures, he shall carefully locate all such structures and conduct his operations so as to avoid

any damage to them. If the Contractor wishes to have any utilities temporarily relocated for his own convenience, he shall make the necessary arrangements with the utility company and reimburse them at his own expense for the cost of the work.

The Contractor shall dig test pits at the direction of the Engineer at the contract price.

55.5 MassDOT Standards

All Specifications and all Special Conditions contained in the bid/contract documents are to be used in conjunction with, and in addition to, the 1988 Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges (current). In all cases, the more stringent Specifications and Special Conditions will apply. The drawings in the Commonwealth of Massachusetts Department of Public Works Construction Standards, 1977 Standards are hereby incorporated by reference.

Additional drawings or directions showing details in accordance with which work is to be done will be furnished from time to time by the Engineer, if found necessary.

The Contractor shall furnish all labor, services, materials, equipment, plant, machinery, apparatus, tools, supplies and all other things necessary to do all work required for the completion of each item of the work and as herein specified. The work to be done and paid for under any item shall include all incidental work necessary or customarily done for the completion of a first class job for that item.

The Contractor shall be responsible for establishing a reproducible construction baseline prior to construction and setting and maintaining line and grade for the duration of the project. All work carried out for line, grade and quality control shall be under the direct supervision of a Registered Professional Engineer (referred to as the Contractor's Engineer) being licensed to practice in the Commonwealth of Massachusetts.

55.6 Local Licensing Requirements

The successful bidder on this project will be required to secure all permits and licenses necessary for the proper execution and completion of the work. The standard licensing fees owed to the City of Marlborough shall be waived for the purposes of this contract; however, all other licensing requirements shall be met and the Contractor shall thoroughly familiarize himself with the standard licensing requirements of the City of Marlborough. The General Contractor is responsible for arranging inspections as required pursuant to applicable laws, rules, regulations and ordinances.

55.7 Hours of Work

The hours of work shall be between 7:00 A.M. and 3:30 P.M., Monday through Friday. There will be no work authorized beyond these limits unless expressly approved and authorized by the City or unless otherwise provided in the Contract.

55.8 Owner's Right to Perform Construction and to Award Separate Contracts

The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such claim as provided elsewhere in the Contract Documents.

The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing and coordinating their construction schedules with one another when directed to do so.

55.9 Authority Of The Owner

The City Engineer or his designee/Engineer shall be the sole judge of the intent and meaning of the Contract and his decision thereon and his interpretation thereof, shall be final, conclusive and binding on all parties. The City Engineer shall be the City's representative during the life of the Contract as directed, instructed, determined or decided by said City Engineer. Approval of the Subcontractor(s) by the City Engineer is necessary before the start of work by said Subcontractor.

Special Conditions Of Contract

SPECIAL CONDITIONS

Simarano Drive Project
Contract ED 2014-21

The project is primarily located within a commercial district. Every attempt is to be made to minimize disruption to businesses, residents and employees during construction.

The work under this Contract consists of transportation improvements on Simarano Drive, including traffic signal upgrades, roadway reconstruction, and the addition of a sidewalk. The project limits extend from just north of Forest Street onto Ames Street, and south to Cedar Hill Street. The overall project length is approximately 6,650 linear feet with a break in work of approximately 900 feet at the I-495 on/off ramp intersection. The work at the I-495 on/off ramp intersection will be completed under a separate project.

Careful attention is to be paid to emergency response vehicles, solid waste/recycling vehicles, business and residential access and dust control throughout the construction phase; adherence to the hours of work is anticipated Monday – Friday 7:00 a.m. – 3:30 p.m. Any excavated material or equipment shall not hinder the use of the roadway for the purpose of emergency response vehicles. Please refer to the General Conditions Section 55.4 Notice to Utilities in this contract document for the necessary utility, and emergency response contact numbers.

Construction methods and material requirements for the installation of ductile water main shall conform in all aspects to “The American Water Works Association Standard Specifications” as amended, except for items the City has specified herein. All work shall be performed in accordance with the Code of the City of Marlborough Department of Public Works, Water Use Regulations. The Water & Sewer Division of the Department of Public Works shall approve all construction and materials.

All work shall also be performed in accordance with the Code of the City of Marlborough, with all construction and materials shall be approved by the Engineering Division of the Department of Public Works. Reference is made to the Massachusetts Department of Transportation’s Standard Drawings, which are hereby made part of this contract.

General Contractor’s Guarantee Form

GENERAL CONTRACTOR'S GUARANTEE FORM

(To be submitted in Duplicate after Completion of Contract Work)

Building: _____ Location: _____

Project No. _____ Date: _____

To: City of Marlborough

We (I) hereby guarantee all materials and workmanship, executed under the Agreement between the City of Marlborough and _____ dated
(General Contractor)
_____.
for the construction of and change orders thereto, including revisions to Drawings and modifications to Specifications for a period of one (1) year from date of substantial completion, except for the following work which is guaranteed for the time indicated for the date of substantial completion as hereinafter noted:

(Work)	(Subcontractor)	(Guarantee Period YEARS)
(Work)	(Subcontractor)	(Guarantee Period YEARS)
(Work)	(Subcontractor)	(Guarantee Period YEARS)

The guarantee is for all work whether executed by our own or our Subcontractor's forces. Copies of all required guarantees executed by our various Subcontractors are attached.

We agree to correct or have correct, without cost to the City, any imperfect materials or equipment whether or not partially or completely covered by manufacturer's guarantee, or which were not installed in accordance with the plans and specifications, at any time during the period of the guarantee. Any material or equipment which in the opinion of the Designer requires excessive service at any time during the first year of operation shall be considered defective and shall be replaced under this guarantee at no expense to the City. As to equipment or parts thereof which are replaced, the one (1) years guarantee, or longer, as per warranty and/or guarantee provisions, shall run from the approved date of substantial completion of the replaced equipment installation or parts thereof.

All items contained in the final punch list and corrected or replaced after the approved date of substantial completion shall extend the guarantee of those items to correspond to one year after their final completion.

All corrections to defective work will be done at the convenience of the City and will include all labor and material necessary to remove and replace any part of the building or its equipment installed under the Agreement noted above, where such removal may be necessary to complete the corrective work. We further agree to make, or have made, any corrections or adjustments to meet specified performance results.

Should the City, for its convenience, require the work to be done during other than regular working hours, the City shall pay all extra costs involved by such requirements.

It is understood that the City will give notice of observed defects with reasonable promptness and that all questions arising under this guarantee shall be decided by the Designer.

Approved date of substantial completion of the work: _____

Date of expiration of this guarantee: _____

SIGNED by General Contractor: _____ Title of Officer: _____

Special Provisions

SPECIAL PROVISIONS

REFERENCED MATERIAL

The special provisions that follow are intended to be in conjunction, and in addition to, the 1988 Commonwealth of Massachusetts, Massachusetts Highway Department, Standard Specifications for Highways and Bridges, as supplemented, with the June 15, 2012 Massachusetts Department of Transportations' Supplemental Specifications. These documents are referenced by language "Standard Specifications", "Section", "Subsection" in the following special provisions.

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.

COOPERATION OF THE CONTRACTOR
(Supplementing Subsections 5.05 and 5.06)

Agents of various public service agencies, municipal and State Departments, and private site contractors may be entering on the work site to remove existing utilities, to construct or place new facilities or to make alterations to existing facilities.

The Contractor shall perform the work in cooperation with the various agencies in a manner which causes the least interference with the operations of the aforementioned agencies and shall have no claim for delay which may be due, or result, from said work of these agents.

There is a project currently under construction at the Atlantic-Marlborough, LLC property along Simarano Drive. Work shall be coordinated at driveways located at Stations 23+75± & 37+75±. The project is being managed by Atlantic Management Corporation, and the contact information is:

Tony Sanchez
Avalon Bay Communities, Inc.
Senior Project Manager
51 Sleeper Street, Suite 750
Boston, MA 02210
(617) 654-9575

CONSTRUCTION STAKING **(Supplementing Subsection 5.07)**

The Contractor will be furnished information and ties for the survey baseline and benchmarks. The Contractor shall perform all survey required for the work.

PUBLIC SAFETY AND CONVENIENCE
(Supplementing Subsection 7.09)

The Contractor shall provide necessary access for fire apparatus and other emergency vehicles through the work zones to abutting properties at all times.

Sweeping and cleaning of surfaces beyond the limits of the project required 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.

PROTECTION OF UTILITIES AND PROPERTY
(Supplementing Subsection 7.13)

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 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 City or by the utility owner which suffers the loss. The cost of such repairs shall be borne by the Contractor, without compensation therefor.

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 therefor.

WORK IN THE IMMEDIATE VICINITY OF CERTAIN UNDERGROUND STRUCTURES AND UTILITY POLES

For overhead connections, National Grid will make the connection from the top of the riser on the utility pole to the power source. The Contractor shall supply all labor, materials and equipment to install the service connection, complete in place and in accordance with the National Grid procedures, from the controller to and including the riser with enough wire coiled above the riser to permit National Grid to make the final connection.

For underground connections, National Grid will perform the actual wiring of the service connections from its power source to the sweep at the local controllers, but all steel sweeps, ducts, entrance holes into manholes, patching and all other necessary labor, materials and equipment required to install the electric service, complete in place, shall be furnished by the Contractor.

The Contractor shall pay National Grid for their services rendered for the connection of overhead and underground service connections.

Before starting work at existing manholes, the Contractor shall test for gas and blow out the manholes.

PROVISIONS FOR TRAVEL AND PROSECUTION OF THE WORK
(Supplementing Subsection 8.03)

Before starting any work under this Contract, the Contractor shall prepare, and submit to the Engineer for approval, a plan (based on the Contract traffic management plans) that indicates the traffic routing proposed by the Contractor during the various stages and time periods of the work and the temporary barricades, signs, drums and other traffic control devices to be employed during each stage and time period of the work to maintain traffic and access to abutting properties.

Particular care shall be taken to establish and maintain methods and procedures that will not create unnecessary or unusual hazards to public safety. Traffic control devices required only during working hour operations shall be removed at the end of each working day.

Signs having messages that are irrelevant to normal traffic conditions shall be removed or properly covered at the end of each work period. Signs shall be kept clean at all times and legends shall be distinctive and unmarred.

TEMPORARY ACCESS TO AREA MERCHANTS AND BUSINESSES
(Supplementing Subsections 8.02 and 8.06)

The work is in a predominantly commercial business section of the City and access to all properties must be maintained at all times.

The Contractor shall provide safe and ready means of ingress and egress to all stores and shops, public and private and professional offices and any other businesses or residences in the project area, both day and night, for the duration of the project.

WORK DONE BY OTHERS

Relocation and/or resetting to new grades of all private utilities, including utility poles, made necessary by the construction of this project, will be accomplished by the respective utility companies.

MATERIAL REMOVED AND STACKED

The Contractor shall carefully remove, transport and stack all material that, in the opinion of the Engineer, is salvageable. The material shall be stacked at Marlborough DPW, 135 Neil Street. The Contractor shall coordinate with the City of Marlborough to schedule drop-off time and location.

DRAINAGE

All drainage castings in new pavement areas shall be installed at base or intermediate course grade, as directed by the Engineer, and reset to proposed finish surface grade prior to placement of the pavement surface course.

All pipes and structures installed as part of this Contract shall be left in a clean and operable condition at the completion of the work.

All existing pipes to be abandoned shall be plugged with brick masonry not less than 8 inches in thickness in conformance with the Standard Specifications, Section 201.62.

No separate payment will be made for the maintenance of the existing drainage system or for plugging of pipes, but all costs in connection therewith shall be included in the unit prices bid for the various Contract items.

DRAINAGE STRUCTURES

Where new pipe is shown on the drawings to be connected into an existing drainage structure to remain, the existing structure shall be first cleaned to remove all mud, debris and other material. The existing structure wall shall be carefully and neatly cut to provide the minimum size opening required for the insertion of the new pipe. The proposed pipe end shall be set or cut off flush with the inside face of the existing structure wall and the remaining space around the pipe completely filled with cement grout for the full thickness of the structure wall.

Existing shaped inverts shall be reconstructed as necessary to provide a smooth and uniform flow channel from the new pipe through the existing structure.

No separate payment will be made for the cost of connecting new pipes into existing structures and necessary alterations of existing structures, but all costs in connection therewith shall be included in the unit prices bid for the various pipe items.

SAWCUTS

Existing pavements to remain shall be sawcut at all openings for utility work, for new or reset curb and at all joints with proposed full-depth hot mix asphalt pavement, as shown on the plans and as directed by the Engineer.

MAINTENANCE OF TRAFFIC SIGNALS

It shall be the responsibility of the Contractor to provide all labor, equipment and material required for the total maintenance and repair of all existing and proposed traffic signal control equipment, including damage by automobile accidents until final completion and acceptance of the project, unless otherwise specified under Subsection 7.17 “Traffic Accommodation: of the Standard Specifications as amended, in which case Subsection 7.17 will govern. These provisions will apply to the signalized location included as part of this construction Contract from the date of written notice given to the Engineer that the Contractor will work on or adjacent to an existing signal until the date when the City accepts the complete project. This written notice must be given before the Contractor may proceed with any work on a specified traffic signal location. For the purpose of these Special Provisions, the phrase “Traffic Signal Control Equipment” is intended to include, but is not limited to, controllers, signal housings, supporting

structures, cabinet accessories and panels, wires, conduit and all other ancillary electrical equipment used for traffic control.

The cost of the maintenance of signals shall be deemed to be included in the various traffic signal Contract items and no additional payments will be made.

FINE TUNING, ADJUSTMENT, AND TESTING PERIOD

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

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

FINAL INSPECTION AND ACCEPTANCE

Upon successful completion of the 30 day testing period wherein the traffic signal systems have operated for 30 days without failure, the Contractor shall notify the City of Marlborough. The Engineer will make a final inspection of the installation in the presence of the City and the Contractor. An inspection check will be made to ensure that all equipment, materials, installations and operations are in accordance with the construction contract, plans and specifications. Items to be checked will include, but not be limited to, traffic signal systems and rectangular rapid flashing beacon operation, cabinet equipment, documents (wiring diagrams, as-built plans, instruction manuals, parts list, warranties, grounding resistivity test report, etc.), signs, and pavement markings, and street hardware (posts, bases, housings, brackets, etc.).

The Engineer will notify the Contractor in writing of any items in which the inspection reveals that the work is incomplete, defective, or does not otherwise meet the project specifications. The Contractor shall perform the corrective actions necessary to achieve final acceptance by the City of Marlborough. These corrective actions shall be done by and at the expense of the contractor and within 15 days of the date of the inspection report, unless otherwise approved in writing by the City.

GUARANTEE AFTER FINAL ACCEPTANCE

The Contractor shall diagnose (troubleshoot) the system and replace any part of the traffic signal systems and/or rectangular rapid flashing beacon operation, found to be defective in workmanship, material or manner of functioning within six months from date of final acceptance of all the installations under this Contract. This requirement does not affect the one-year warranty period on equipment specified in Subsection 815.20 of the Standard Specifications.

Upon the date of acceptance of the project by the City, the Contractor shall turn over all guarantees and warranties to the City of Marlborough.

QUALIFIED ELECTRICIANS

Within 10 days after opening of bids, the low bidder shall submit a list of the Journeyman Electricians (Massachusetts License) who will perform the electrical work in this contract.

Also, the low bidder shall submit copies of each Journeyman Electrician's current Massachusetts License.

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 and/or realigned by the Contractor as directed by the Engineer at no cost to the Owner.

ORDER OF CONDITIONS

The Contractor is advised that the Order of Conditions, (#212-1125) issued by the City of Marlborough on 4/16/2014, is part of this contract. A copy of this order is included within these special provisions.

The Contractor shall be responsible for meeting all the orders for conditions attached. No separate payment will be made for complying with the orders of conditions, except as noted in the special provisions, but all costs in connection therewith shall be included in the unit prices bid for the various contract items.

ARCHITECTURAL ACCESS BOARD TOLERANCES

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

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

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

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

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

RESTRICTED MATERIALS

All new construction materials shall be asbestos-free including any roofing felt, adhesives, waterproofing materials, grout, or sealer that may be used in project construction.

All yellow temporary and permanent pavement markings, including all pavement marking tape, placed as part of this project shall be lead-free.

ITEM 101. CLEARING AND GRUBBING ACRE

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

Clearing and grubbing shall be performed only in the locations shown on the plans and as directed by the engineer. When within the existing or proposed right-of-way, the clearing and grubbing limits shall be 5 feet past the limit of grading. In locations where the existing right of way or proposed easement lines are closer than 5' from the limit of grading, the contractor shall end the work at the Right-of-Way line.

Method of Measurement

Clearing and Grubbing will be measured by the acre only in the locations shown on the plans or as directed by the Engineer.

Basis of Payment

Clearing and Grubbing will be paid for at the Contract unit price per acre, which price shall include all labor, materials, equipment, disposal of removed trees/shrubs, and incidental costs to perform the work.

ITEM 102.1 **TREE TRIMMING** **FOOT**

The work under this item shall conform to the relevant provisions of Section 8.08 and 101 of the Standard Specifications and the following:

This work includes the trimming of low hanging tree limbs in the clear zone or in areas adjacent to the proposed roadway/sidewalk.

Work under this item shall be done only upon direction by the Engineer.

The method of disposal of all materials shall be the responsibility of the Contractor and shall be approved by the Engineer. All methods of disposal shall be accomplished in accordance with all applicable Federal, State and local ordinances.

Tree trimming will be paid for at the cost per foot price bid for Item 102.1, which price shall include all labor, material, equipment and incidental costs required to complete the work.

ITEM 102.51 INDIVIDUAL TREE PROTECTION EACH

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

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

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

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 this item, 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 City 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.

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 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.

CONSTRUCTION METHODS

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.

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.

ITEM 102.51 (Continued)

Cutting and Pruning

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

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

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

Watering

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

Removal of Protection

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

Tree Damage

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

Method of Measurement

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.

ITEM 102.51 (Continued)

Basis of Payment

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.

Payment under this item 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.

Cost of wood chips, as required, shall be incidental to this item.

ITEM 201.	**CATCH BASIN**	**EACH**
ITEM 203.	**SPECIAL MANHOLE**	**EACH**
ITEM 222.21	**FRAME AND GRATE DROP INLET - MUNICIPAL STANDARD**	**EACH**
ITEM 222.3	**FRAME AND GRATE (OR COVER) - MUNICIPAL STANDARD**	**EACH**
ITEM 223.1	**FRAME AND GRATE (OR COVER) REMOVED AND STACKED**	**EACH**

The work under these items shall conform to the relevant provisions of Sections 201 and 220 of the Standard Specifications, the City of Marlborough Standards, and the following:

All proposed catch basins shall be constructed with a minimum 4-foot sump. Eccentric cones may be required to install proposed catch basins and avoid existing trees, utilities, or other objects.

The special manhole shall have a 6' inside diameter.

Existing frames and grates or covers from existing structures shown on the drawings to be abandoned or removed, or changed in type, shall be removed and stacked unless, in the judgment of the Engineer, they are unsuitable for salvage. Unsuitable frames, grates and covers shall become the property of the Contractor and shall be disposed of off the site at no additional cost to the Owner. New frames, grates and covers shall be furnished and installed for new structures and change in type structures.

New frames, grates, and covers for manholes, catch basins, and drop inlets shall meet the City of Marlborough standards as shown in the details.

Method of Measurement

Measurement for Items 201, 203, 222.21, 222.3 and 223.1 will be made by the unit each. Deep sump catch basins shall be measured as one unit each.

Basis of Payment

Catch Basin, Special Manhole, Frame and Grate Drop Inlet - Municipal Standard, Frame and Grate (or Cover) – Municipal Standard, and Frame and Grate (or Cover) Removed and Stacked will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 241.12	**12 INCH REINFORCED CONCRETE PIPE**	**FOOT**
ITEM 241.15	**15 INCH REINFORCED CONCRETE PIPE**	**FOOT**
ITEM 241.18	**18 INCH REINFORCED CONCRETE PIPE**	**FOOT**

The work under these items shall conform to the relevant provisions of Sections 230 of the Standard Specifications, the City of Marlborough Standards, and the following:

All existing corrugated metal pipe located underneath the roadway shall be removed and replaced with reinforced concrete pipe of the same size.

The existing corrugated metal pipe replacement shall end one foot behind the back of curb, edging or berm. The contractor shall connect the remaining existing corrugated metal pipe to reinforced concrete pipe per the construction detail provided in the Contract Documents, or by a similar method approved by the Engineer.

Method of Measurement

Measurement for Items 241.12, 241.15, 241.18 will be made by the contract unit price per foot.

Basis of Payment

Items 241.12, 241.15, 241.18 will be paid for at the Contract unit prices per foot, which prices shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for connecting the existing corrugated metal pipe to the reinforced concrete pipe. All costs associated with this work shall be included under Items 241.12, 241.15, 241.18.

ITEM 301.1 WATER LINE RELOCATION AT STRUCTURES EACH

The work under this item shall conform to the relevant provisions of Sections 300 of the Standard Specifications, the City of Marlborough Standards, and the following:

At locations where the existing waterline is in conflict with a proposed drainage structure, the waterline shall be relocated to be a minimum of 1' offset from the edge of the structure, as shown in the construction detail provided in the Contract Documents. The waterline shall be relocated using 45˚ bends, and new ductile iron pipe. New ductile iron pipe shall be the same size as the existing waterline.

This item is only to be used when directed by the engineer. No compensation will be made for work under this item done without prior written approval of the engineer.

Any temporary water shut downs must first be approved by the City of Marlborough Fire Department and Department of Public Works.

Method of Measurement

Measurement for Item 301.1 will be made by the contract unit price per each.

Basis of Payment

Item 301.1 will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for excavation, backfilling, temporary water, pipe connections, fittings, ductile iron pipe, and its costs shall be included under Item 301.1.

ITEM 303.06	**6-IN. DUCTILE IRON WATER PIPE (MECHANICAL JOINT)**	**FOOT**
ITEM 309.	**DUCTILE IRON FITTINGS FOR WATER PIPE**	**POUND**
ITEM 357.06	**6 INCH GATE BOX**	**EACH**
ITEM 357.12	**12 INCH GATE BOX**	**EACH**
ITEM 376.2	**HYDRANT REMOVED AND RESET**	**EACH**
ITEM 376.5	**HYDRANT ADJUSTED**	**EACH**

The work under these items shall conform to the relevant provisions of Section 300 of the Standard Specifications and the following:

The work under these items shall conform to the relevant provisions of Section 300 of the Standard Specifications, the City of Marlborough Water Department Specifications and the following:

The work shall include the furnishing and installation of all materials required to remove and reset existing hydrants and to replace gate boxes that cannot be adjusted.

Approval of Materials

The Contractor shall submit the names of the material suppliers, shop drawings and certificates of compliance to the Engineer for approval prior to ordering any materials.

Pipe and Fittings
Pipe shall be ductile iron, Class 52, conforming to ANSI A21.50/AWWA C150 and ANSI A21.51/AWWA C151.

Fittings shall be ductile iron, Class 250 minimum, conforming to applicable ANSI, NEWWA, and AWWA specifications.

Pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside and a coal tar enamel coat on the outside in accordance with ANSI A21.4 (AWWA C104) and ANSI A21.6 (AWWA C106), as amended, except that the cement mortar lining shall be 1/8-inch in thickness for pipe 2 inches to 12 inches in diameter. Bituminous seal coat shall be a product acceptable to the National Sanitation Foundation (NSF) for use in potable water and shall be so listed in the most current NSF summary of approved products under ANSI/NSF Standards 61.

Pipe shall be standard restrained mechanical joint pipe.

Rubber gaskets for mechanical joints shall conform to ANSI A21.11/AWWA C111.

Pipe shall be supplied in lengths not exceeding 20 feet. Each pipe and fitting shall markings casted into the metal in accordance with ANSI A21.10/AWWA C110, including manufacturer's identification, country material was made in, pressure rating, nominal diameter and degrees or fraction of circle (for bends).

ITEMS 303.06 THRU 376.5 (Continued)

Pipe and Fittings Installation
The Contractor shall make all necessary arrangements with the City of Marlborough Water and Fire Departments for the necessary shutdowns of service.

The City of Marlborough Water Department may establish the time of shutdown to be within the normal daily low demand period.

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipes, fittings or coatings. Pipe and fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer. Any pipe found to be defective, before or after laying, shall be satisfactorily removed and replaced with sound pipe at no additional cost to the Owner.

All pipe and fittings shall be installed in conformance with AWWA Standard Specifications C600, except as otherwise provided herein. All pipe and fittings shall be sound and clean before laying and shall be laid on a shaped bedding providing uniform, firm support over the entire length of each section barrel. BLOCKING WILL NOT BE PERMITTED. The select bedding material shall be placed and tamped along the sides of the pipe to complete the bedding.

Pipe shall be laid with good alignment and at a uniform 5-foot depth to top of pipe below proposed grade except where extra depth is required to clear other utilities and to connect to existing pipes, valves or fittings. Joint deflection shall not exceed that recommended by the manufacturer. Additional fittings shall be furnished and installed as required to cross existing utilities. Solid sleeves shall be used only where approved by the Engineer.

When pipe laying is stopped for any length of time, including short periods, the open ends of the pipe and fittings shall be closed with a watertight plug or cap as approved by the Engineer.

Necessary pipe cutting shall be accomplished by power saw and shall leave a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.

Mechanical joints shall be installed in accordance with the "Notes of Method of Installation" of ANSI A21.11 and the instructions of the manufacturer. The Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torques. Extension wrenches or pipe over handle or ordinary ratchet wrench shall not be used to secure greater leverage.

Water/Sewer Separation
When a water pipe crosses above or below a sewer pipe, the following procedures shall be utilized. The Contractor shall comply with these following procedures:

Whenever possible, water mains shall be laid at a minimum at least 10 feet, horizontally, from any existing sewer. Should local conditions prevent a lateral separation of 10 feet, a water main may be laid closer than 10 feet to a sewer if:

a. It is laid in a separate trench, or if;

ITEMS 303.06 THRU 376.5 (Continued)

b. It is laid in the same trench with the sewer located at one side on a bench of undisturbed earth, and if;

c. In either case, the elevations of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

Whenever water mains must cross under sewers, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water tightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure water tightness or both pipes shall be encased in concrete.

Gate Boxes

The Contractor shall assume that of the existing gate boxes requiring adjustment 30% of the gate boxes are worn and shall require replacement. All existing gate boxes not suitable for re-use shall become the property of the contractor and shall be disposed of properly off-site. No additional compensation shall be provided for the removal and disposal of the existing boxes. All costs shall be included in the unit price for the new gate box.

Gate boxes shall be two-section, cast iron, heavy pattern adjustable type, with cast iron cover. The upper sections shall have a bottom flange of sufficient bearing area to prevent settling. The bottom section shall enclose the valve stuffing box and operating nut. Boxes shall be of lengths adapted to 5-foot pipe cover or more and have a minimum of 6 inches of overlap in the most extended position. Covers shall have the word "WATER" cast in the top and shall be held in place with bronze bolts.

Couplings

Couplings shall be used to (1) repair split pipe or replace sections of damaged pipe; (2) install or cut-in hydrants or valves into a water main; (3) couple different pipe types; and (4) correct misaligned pipe ends. Couplings shall have a pressure rating of 250 psi or greater. Materials shall be manufactured in accordance with the following:

(1) Center and end rings: ASTM-A536
(2) Gaskets: ASTM D2000
(3) Bolts & Hex Nuts: AWWA C111

Couplings shall be epoxy-coated.

ITEMS 303.06 THRU 376.5 (Continued)

Pipe Insulation
Pipe insulation shall be installed in locations indicated on the plans and when water main cannot be installed with at least 5 feet of cover. Pipe insulation shall be installed with waterproof jacket in accordance with MassDOT M11.0 and MassDOT Section 301.60. Insulation thickness shall be as indicated on the plans.

Hydrant Installation
Hydrants shall be set at the locations shown on the drawings, or as directed by the Engineer, and bedded on a firm foundation. A drainage pit 2 feet 6 inches in diameter shall be back-filled with crushed stone in conformance to M2.01.1 and satisfactorily compacted. Additional stone shall be brought up and around 6 inches over the drain ports. Each hydrant shall be set in true vertical alignment and properly braced. A concrete thrust block shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Felt roofing paper shall be placed around hydrant elbow before placing concrete. Care shall be taken to insure that concrete does not plug the drain ports. Hydrant paint shall be touched up as required after installation.

Hydrant Adjusted
At Station 67+80, the hydrant needs to be adjusted up to match the proposed grade. The Contractor shall submit the method of adjustment to the Engineer for approval. Hydrant paint shall be touched up as required after the hydrant is adjusted. Hydrant adjustment is for the vertical adjustment of the hydrant to finished grade only, not horizontally.

Thrust Restraints
Thrust restraints shall be installed at all tees, bends, plugs, caps, tapping sleeves and other locations as directed by the Engineer in accordance with the dimensions and details shown on the plans.

Whenever water pipes can be placed against undisturbed earth, concrete thrust blocks may be installed. The back of thrust blocks shall be placed against undisturbed earth and the sides shall be formed. Felt roofing paper shall be placed to protect pipe joints. Concrete shall not be placed over bolts or nuts, or in a manner which prevents the removal of joints.

Concrete shall have a minimum strength Class of 3,000 psi.

Whenever water pipes are installed within fill sections, the Contractor shall use mechanical restrained joint pipe and wedge-type mechanical joint restraints rated for 350 psi.

Method of Measurement

Water pipe will be measured in placed along the axis of the pipe without deduction for the space occupied by valves, excluding however, the length occupied by new fittings.

The fittings will be measured by the pound and the quantity to be paid for shall be the weight stated on the invoice of the supplier or the manufacturer's rated weight as listed in the catalog whichever is the lesser.

6" Gate Box, 12" Gate Box, and Hydrant Removed and Reset, will be measured for payment as units, complete in place. 6" Gate Box & 12" Gate Box will be measured by the actual number of Gate Boxes replaced.

ITEMS 303.06 THRU 376.5 (Continued)

Basis of Payment

6 Inch ductile iron water pipe (Mechanical Joint) will be paid for at the contract unit price per foot, which price shall include all labor, material, equipment and incidental costs required to complete the work.

Ductile iron fittings for water pipe will be paid for at the contract unit price per pound, which price shall include all labor, material, equipment and incidental costs required to complete the work.

6" Gate Box, 12" Gate Box, and Hydrant Removed and Reset will be paid for at the Contract unit price per each, which prices shall include all labor, material, equipment and incidental costs required to complete the work.

Adjusting hydrants will be paid for at the Contract unit price per each, which price shall include all labor, material, equipment and incidental costs required to complete the work. The furnishing of extension barrels, rods and couplings is included as part of this item.

No separate payment will be made for excavation, concrete for thrust blocks, gravel borrow and crushed stone bedding and backfill, insulation, but all costs in connection therewith shall be included in the unit prices bid for the respective items.

No separate payment will be made for the removal, transporting and stacking or disposal of the existing materials, but all costs in connection therewith shall be included in the unit prices bid for the respective items.

ITEM 415. PAVEMENT MICRO-MILLING SQUARE YARD

Item 415 – Pavement Micromilling shall conform to the same requirements for Section 130 Pavement Milling within Section 450.

Description

415.20 General.

This work shall consist of micromilling and removal of existing Hot Mix Asphalt (HMA) pavement courses from the project by the Contractor. Micromilling shall be performed in conformity with the approved QC Plan. The Contractor shall present and discuss in sufficient detail the Quality Control information and activities related to milling at the Construction Quality Meeting required under Section 450. Unless otherwise specified, the milled material shall become the property of the Contractor.

Construction Procedures

415.60 General.

All construction procedures under Pavement Micromilling shall also conform to any of the following relevant provisions of Pavement Milling:

Milling Equipment Requirements.

The milling equipment shall be self-propelled with sufficient power, traction, and stability to remove the existing HMA pavement to the specified depth and cross-slope. The milling machine shall be capable of operating at a minimum speed of 10 feet (3 meters) per minute, designed so that the operator can at all times observe the milling operation without leaving the control area of the machine, and equipped with the following:

(a) A built in automatic grade control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results.

(b) Longitudinal controls capable of operating from any longitudinal grade reference, including string line, 30 foot (10 meter) ski minimum, 30 foot (10 meter) mobile string line minimum, or a matching shoe.

(c) The transverse controls shall have an automatic system for controlling cross-slope at a given rate.

ITEM 415. (Continued)

(d) Cutting heads able to provide a minimum 6 foot (2 meter) cutting width and a 0 to 4 inch (0 to 100 mm) deep cut in one pass. The teeth on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.

(e) An integral pickup and conveying device to immediately remove milled material from the roadway and discharge the millings into a truck, all in one operation.

(f) All necessary safety devices such as reflectors, headlights, taillights, flashing lights and back up signals so as to operate safely in both day and night.

(g) A means of effectively limiting the amount of dust escaping from the milling and removal operation in accordance with local, State, and Federal air pollution control laws and regulations.

When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a smaller or lesser-equipped milling machine may be permitted when approved by the Engineer.

Sweeper Equipment Requirements.

The Contractor shall provide a sufficient number of mechanical sweepers to ensure that the milled surface is free of millings and debris at the end of each day's milling operations. Each sweeper shall be equipped with a water tank, spray assembly to control dust, a pick-up broom, a dual gutter broom, and a dirt hopper. The sweepers shall be capable of removing millings and loose debris from the textured pavement.

Milling Operations.

The milling operations shall be scheduled to minimize the duration and placement of traffic on the milled surface. Under no circumstances shall the milled surface be left exposed to traffic for a period exceeding seven days. The Engineer may allow the Contractor to adjust the above limitations on milling production when necessary.

The Contractor shall coordinate milling and paving operations to minimize the exposure of milled surfaces to traffic. The Contractor shall ensure that milled surfaces are overlaid in a timely manner to avoid damage to the pavement structure. Any damage to the pavement structure resulting from extended exposure of the milled surface to traffic shall be repaired as directed by the Engineer at the Contractor's expense.

ITEM 415. (Continued)

The existing pavement shall be removed to the average depth shown on the plans, in a manner that will restore the pavement surface to a uniform cross-section and longitudinal profile. The longitudinal profile of the milled surface shall be established using a 30 foot (10 meter) mobile ski, mobile string line, or stationary string line. The cross-slope of the milled surface shall be established by a second sensing device or by an automatic cross-slope control mechanism. The Contractor will be responsible for providing all grades necessary to remove the material to the proper line, grade, cross section, superelevation, and transitions shown on the plans or as directed by the Engineer. The requirement for automatic grade or slope controls may be waived by the Engineer in locations warranted by the situation, including intersections and closely confined areas.

The Engineer may adjust the average milling depth specified on the plans by ± 3/4" (± 20mm) during each milling pass at no additional payment to minimize delamination of the underlying pavement course or to otherwise provide a more stable surface. If delamination or exposure of concrete occurs when milling a HMA pavement course from an underlying Portland Cement Concrete (PCC) pavement, the Contractor shall cease milling operations and consult the Engineer to determine whether to reduce the milling depth or make other adjustments to the operation.

Protection of Inlets and Utilities.

Throughout the milling operation, protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense. To prevent the infiltration of milled material into the storm sewer system the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that falls into inlet openings or inlet grates shall be removed at the Contractor's expense.

Vertical Faces.

All permanent limits of the milled area shall be sawcut or otherwise neatly cut by mechanical means to provide a clean and sound vertical face. No vertical faces, transverse or longitudinal, shall be left exposed to traffic. If any vertical face is formed in an area exposed to traffic a temporary paved transition with a maximum 12:1 slope shall be established. If the milling machine is used to temporarily transition the milled pavement surface to the existing pavement surface, the temporary transition shall be constructed at a maximum 12:1 slope.

ITEM 415. (Continued)

Opening to Traffic.

Prior to opening a milled area to traffic, the milled surface shall be thoroughly swept with a mechanical sweeper to remove all remaining millings and dust. This operation shall be conducted in a manner so as to minimize the potential for creation of a traffic hazard and to comply with local, State, and Federal air pollution control laws and regulations. Any damage to vehicular traffic as a result of milled material becoming airborne is the responsibility of the Contractor and shall be repaired at the Contractor's expense. Temporary pavement markings shall be placed in accordance with the provisions of Subsection 850.64.

Milled Surface Inspection.

The milled surface shall provide a satisfactory riding surface with a uniform textured appearance. The milled surface shall be free from gouges, excessive longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, non-uniform milling teeth, improper use of equipment, or otherwise poor workmanship. Any unsatisfactory surfaces produced shall be corrected by remilling at the Contractor's expense and to the satisfaction of the Engineer.

The Contractor shall perform Quality Control inspection of all work items addressed as specified in the table below. Inspection activities during milling of HMA pavement may be performed by qualified Production personnel (e.g. Skilled Laborers, Foremen, Superintendents). However, the Contractor's QC personnel shall have overall responsibility for QC inspection. The Contractor shall not rely on the results of Department Acceptance inspection for Quality Control purposes. The Engineer shall be provided the opportunity to monitor and witness all QC inspection.

The milled surface of each travel lane shall be divided into longitudinal Sublots of 500 feet (150 meters). The Contractor shall perform a minimum of one random QC measurement within each Sublot with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. Additional selective QC measurements within each Sublot will be performed as deemed necessary by the QC personnel. All QC inspection results shall be recorded on NETTCP Inspection Report Forms. The Engineer will also randomly inspect a minimum of 25% of the Sublots. The Contractor shall perform surface texture measurements with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. The milled surface shall have a texture such that the variation from the edge of the straightedge to the top of ridges between any two ridge contact points shall not exceed 1/8 inch (3 mm). The difference in height from the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed 1/16" (1.6 mm). Any point in the surface not meeting these requirements shall be corrected as directed by the Engineer at the Contractor's expense.

In isolated areas where surface delamination between existing HMA layers or a surface delamination of HMA on Portland Cement Concrete causes a non-uniform texture to occur, the straightedge surface measurement requirements stated in the preceding paragraph may be waived, subject to the approval of the Engineer.

Minimum QC Inspection of Milling Operations

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC Plan	Per QC Plan	Per QC Plan	Per QC Plan
Environmental Conditions	Protection of Inlets & Utilities	Per QC Plan	Existing Surface	Visual Check
	Removal of Millings & Dust	Per QC Plan	Milled Surface	Visual Check
Workmanship	Milling Depth	Per QC Plan	Milled Surface	Check Measurement
	Cross-Slope & Profile	Per QC Plan	Milled Surface	Check Measurement
	Milled Surface Texture	Per QC Plan	Milled Surface	Visual Check
	Milled Surface Roughness	Once per 500 feet(150 meters) per milled lane	Milled Surface per Subsection 410.67	10 foot (3 meter) standard straightedge
	Sawcut Limit Vertical Face	Per QC Plan	Sawcut Limits	Visual Check

415.61 Micromilling Equipment Requirements.

The micromilling machine shall be equipped with a drum specifically designed to provide the surface specified below.

415.62 Control Strip.

The Contractor shall micromill a control strip. The control strip shall be 500 feet minimum in length with a uniformly textured surface and cross slope, as approved by the Engineer.

The micromilled surface of the control strip shall provide a satisfactory riding surface with a uniform textured appearance. The micromilled surface shall be free from gouges, excessive longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, non-uniform milling teeth, improper use of equipment, or otherwise poor workmanship. Any unsatisfactory surfaces produced in the control strip shall be corrected by additional micromilling at the Contractor's expense and to the satisfaction of the Engineer.

ITEM 415. (Continued)

The micromilled pavement surface shall have a transverse pattern of 0.2 – 0.3 inch center to center of each strike area. The Contractor shall perform surface texture measurements with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. The milled surface shall have a texture such that the variation from the edge of the straightedge to the top of ridges between any two ridge contact points shall not exceed 1/8 inch (3 mm). The difference in height from the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed 1/16" (1.6 mm). Any point in the surface not meeting these requirements shall be corrected as directed by the Engineer at the Contractor's expense.

415.67 Micromilled Surface Inspection.

The Contractor shall perform Quality Control inspection of all work items addressed under Section 415.

The micromilled surface shall meet the requirements of 415.62.

Compensation

415.80 Method of Measurement.

Micromilling - Micromilling will be measured for payment by the number of square yards (square meters) of area from which the milling of existing HMA pavement has been completed and the work accepted. No area deductions will be made for minor unmilled areas such as catch basin inlets, manholes, utility boxes and any similar utility structures.

415.81 Basis of Payment.

Micromilling - Micromilling, removal and disposal of existing HMA pavement will be paid for at the contract unit price per square yard. This price shall include all equipment, tools, labor, and materials incidental thereto. No additional payments will be made for multiple passes with the milling machine to remove the existing HMA surface to the grade specified.

No separate payments will be made for: performing handwork removal of existing pavement and providing protection around catch basin inlets, manholes, utility valve boxes and any similar structures; repairing surface defects as a result of the Contractor's negligence; providing protection to underground utilities from the vibration of the milling operation; sawcutting micromilled limits; installing and removing any temporary transition; removing and disposing of millings; furnishing a sweeper and sweeping after milling. The costs for these items shall be included in the contract unit price for Pay Item 415., Pavement Micromilling.

415.82 Payment Items.

415.	Pavement Micromilling	Square Yard

ITEM 450.90	**CONTRACTOR QUALITY CONTROL**	**TON**
ITEM 451.	**HMA FOR PATCHING**	**TON**
ITEM 452.	**ASPHALT EMULSION FOR TACK COAT**	**GAL**
ITEM 453.	**HMA JOINT SEALANT**	**FT**
ITEM 455.23	**SUPERPAVE SURFACE COURSE – 12.5 (SSC – 12.5)**	**TON**
ITEM 455.32	**SUPERPAVE INTERMEDIATE COURSE – 19.0 (SIC – 19.0)**	**TON**

The work under these items shall conform to the relevant provisions of Document 00717 SUPERPAVE REQUIREMENTS contained herein and the following:

The PGAB Grade selected for this Contract is PG 64-28.

The Superpave Base Course shall be paid for under Item 455.32 Superpave Intermediate Course – 19.0 (SIC – 19.0).

REFER TO APPENDIX G FOR SUPERPAVE REQUIREMENTS

ITEM 454.5 LATEX MODIFICATION OF HMA TON

The purpose of this Item is to latex-modify the Superpave Surface, Intermediate, and Base Courses specified under Item 455.23, Item 455.31, and Item 455.41. Item 454.5 includes the cost of the latex, costs associated with injecting the latex into the HMA plant, manufacturer's representative and incidentals. The cost for HMA production and placement is compensated under Section 450 and Section 455.

Mix Design

The latex polymer modifier type and amount shall be included as part of the job mix formula. The Superpave Surface Course 12.5 (SSC-12.5) and the Superpave Intermediate Course 12.5 (SIC-12.5) shall be produced with asphalt binder modification as follows:

Latex Polymer Modified Asphalt Binder

The polymer additive shall consist of unvulcanized Styrene Butadiene Rubber (SBR) in liquid latex form, with a minimum quantity of rubber solids of 3% by weight of the performance grade asphalt binder (PGAB) content of the mix. The PG 64-28 shall be modified to produce a PGAB grade of 70-28.

Quantity: 3% rubber solids by weight of the bitumen content of the mix. (Example: If the latex polymer is 70% solids, weight per gallon is 7.69 lbs = 5.38 lbs solids per gallon. If mix calls for 6% bitumen, 3% = 3.6 lbs of latex solids per ton mix or 0.70 gallons of latex per ton of mix.)

The latex polymer modified asphalt binder shall be injected into the mix at the time of manufacture. In a drum plant, the liquid latex polymer shall be pumped into the asphalt binder through a spud welded to the asphalt binder line just prior to where it enters the drum. The constant rate at which the latex polymer is pumped shall be determined by the mix speed of the drum. In a batch plant, the polymer is pumped directly into the mix five (5) seconds after the asphalt binder starts to dump into the pug mill. Mix time per batch after polymer is pumped in is 45 to 60 seconds.

The plant shall be equipped with an in-line blender and a sample cock for Quality Control and Acceptance purposes.

A metering system shall be attached to a printer which prints a time and date stamp, latex flow rate and cumulative polymer usage during the HMA production, allowing the Engineer to reference the injection rate and latex used against the plant's projection rate. The printout shall be set for a five minute interval. The latex polymer manufacturer will have a professional representative available at the HMA plant during the first day of mix production and placement, and as required thereafter by the Engineer.

The manufacturer of the SBR latex shall provide certified test results for Styrene Butadiene ratio, total rubber solids percentage by weight, pH, ash content, and viscosity to the Engineer prior to mix production.

ITEM 454.5 (Continued)

Mix conforming to the requirements of these Special Provisions shall be placed when the ambient temperature is 50ºF and rising when measured in the shade away from artificial heat.

Mixing temperature shall be 290ºF to 325ºF unless otherwise specified by the Engineer. Mix shall be placed at between 275ºF and 310ºF.

Method of Measurement

Measurement for Latex Modification of Hot Mix Asphalt shall be per ton of asphalt treated with latex.

Basis of Payment

Latex Modification of Hot Mix Asphalt will be paid for at the Contract unit price per ton, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 456. WARM-MIX ASPHALT PAVEMENT TON

All Superpave Hot Mix Asphalt Mixture shall be modified using a WMA additive capable of lowering plant production temperatures to below 260° F. Warm Mix Asphalt additives reduce compaction effort and permit lower production temperatures than conventional hot mix asphalt.

The WMA additive shall be a product listed on the Northeast Asphalt User Producer Group (NEAUPG) website (http://www.superpave.psu.edu/NEAUPG.html), except that no WMA foaming technology will be permitted which requires the mechanical injection of steam or water into the liquid asphalt.

The WMA additive must be compatible with polyphosphoric acid modified binders, polymer modified binders, and the HMA producer's HMA anti-stripping agents. The WMA additive shall be introduced in accordance with the Manufacturer's dosing rates and approved blending methods. The WMA additive Manufacturer shall have an on-site representative at the beginning of paving operations. The Manufacturer's representative shall be available for additional consultation during the remaining Warm Mix production.

All work done under this Item shall conform to the provisions of Sections 450 and 455. The WMA mixture design shall incorporate the requirements of NCHRP Report 691: Mix Design Practices for Warm Mix Asphalt "Draft Appendix to AASHTO R35, Special Mixture Design Considerations and. Methods for Warm Mix Asphalt (WMA)". In addition to the provisions of Sections 450 and 455, laboratory prepared samples that have been manufactured at specified temperatures with and without the WMA additive shall be submitted to MassDOT at least 45 days prior to placement for testing. These samples shall be subject to Hamburg Wheel testing for moisture damage and rutting for verification that the WMA is at least equal in performance to the HMA. Preparation of these samples shall be coordinated with the MassDOT.

Method of Measurement

Measurement for Warm-Mix Asphalt Pavement shall be per ton of asphalt treated with the mix.

Basis of Payment

Warm-Mix Asphalt Pavement will be paid for at the Contract unit price per ton, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

All costs associated with these provisions will be considered incidental to Item 456.

No additional compensation will be provided for the Manufacturer's representative, production of samples, the Warm Mix additive or other incidental costs.

ITEM 470.2 HOT MIX ASPHALT BERM TYPE A - MODIFIED TON

The work under these items shall conform to the relevant provisions of Section 470 of the Standard Specifications and the following:

Hot Mix Asphalt Berm Type A Modified shall be 2'-6" in width. The slope of the berm shall be 1:12 max, as shown on the plan details.

Method of Measurement

Hot Mix Asphalt Berm Type A Modified will be paid for by the contract unit price per ton of hot mix asphalt used.

Basis of Payment

Hot Mix Asphalt Berm Type A Modified will be paid for at the respective Contract unit bid price per ton, which prices shall include all labor, material, tools and equipment, and all incidental cost required to complete the work.

ITEM 482.3 SAWING ASPHALT PAVEMENT FOOT

ITEM 482.4 SAWING CEMENT CONCRETE FOOT

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

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

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

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

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

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

Method of Measurement

Sawing asphalt pavement and sawing cement concrete will be measured for payment by the foot on the pavement surface complete in place.

Basis of Payment

Sawing asphalt pavement and sawing cement concrete will be paid for at the respective Contract unit prices per foot, which prices shall include all labor, materials, equipment, and incidental costs required to complete the work.

No separate payment will be made for the sawcutting of existing pavements required for the proposed traffic signal conduit, but all costs in connection therewith shall be included in the price bid for Item 804.3.

Asphalt Emulsion for Tack Coat will be paid for under Item 452.

HMA Joint Sealant will be paid for under Item 453.

ITEM 504.2 GRANITE CURB TYPE VA4 - SPLAYED END EACH

Work under this item shall conform to the relevant provisions of Section 501 of the Standard Specifications and the following:

The work shall include furnishing and installing curb transition sections at the locations shown on the plans to match into the proposed or existing edge. The curbing shall be type VA4 and shall be a minimum length of six foot- six inches (6'-6"). The curb shall be sawcut to match into the proposed adjacent granite edging at one end and match the granite curb on the other end as shown on the plans.

Granite curb Type VA4 - Splayed End will be measured for payment as a unit complete in place.

Granite Curb Type VA4 - Splayed End will be paid for at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 590. CURB REMOVED AND STACKED FOOT

ITEM 593. EDGING REMOVED AND STACKED FOOT

The work under this item shall conform to the relevant provisions of Section 580 of the Standard Specifications and the following:

The work shall include removing, transportation, and stacking of the existing curb/edging found within the project limits.

The Contractor shall exercise extreme care in the removal, transportation and stacking of the granite edging and curb to avoid damage. It is assumed that 80% of the existing curb/edging is in good condition and should be suitable for stacking. The Contractor shall accept and hold entirely, responsibility for the removal, handling and stacking. Any portions of the existing granite curb damaged or lost either directly or indirectly as a result of the Contractor's operations shall be replaced by the Contractor at no additional cost to the Owner.

The Contractor shall coordinate the stacking of the granite edging and curb corners with the City prior to and at the completion of the above work. The existing granite curb/edging shall be stacked at Marlborough Department of Public Works, 135 Neil Street.

Method of Measurement

Curb Removed and Stacked and Edging Removed and Stacked will be measured for payment by the foot of curbing or edging removed and stacked at the DPW.

Basis of Payment

Curb Removed and Stacked and Edging Removed and Stacked will be paid for at the Contract unit prices per foot, which prices shall include all labor, materials, equipment, and incidental costs required to complete the work.

No separate payment will be made for disposal for curbing not suitable for re-use. Unsuitable curbing shall become the property of the Contractor and shall be disposed of off the site at no additional cost to the Owner.

ITEM 620.1 STEEL W BEAM HIGHWAY GUARD - (SINGLE FACED) FOOT

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

MassDOT Standard Detail E 401.12.0 shall be used in locations where the proposed guardrail crosses the existing gas line or other utility.

Steel W Beam Highway Guard – (Single Faced) will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment, and incidental costs required to complete the work, including the work required for MassDOT Standard Detail E401.12.0.

ITEM 620.15 STEEL W BEAM HIGHWAY GUARD - DEEP POST (SINGLE FACED) FOOT

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

The work shall include the furnishing and installation of highway guard with extra depth posts where proposed on the plans.

The highway guard shall meet the material specifications and construction standards for Item 620.1 with the exception of the post depth and length of the level area behind the guardrail.

The depth of the post shall be 8'-6".

The level area shall be a minimum of 1 foot from the back of guardrail to the top of slope.

MassDOT Standard Detail E 401.12.0 is proposed in locations where the proposed guardrail crosses the existing gas line. No extra payment will be made for the concrete, and any hardware required to perform this work and costs shall be included under Item 620.15.

Method of Measurement

Steel W Beam Highway Guard – Deep Post (Single Faced) will be measured for payment by the foot of highway guard installed.

Basis of Payment

Steel W Beam Highway Guard – Deep Post (Single Faced) will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment, and incidental costs required to complete the work, including the work required for MassDOT Standard Detail E401.12.0.

ITEM 635. HIGHWAY GUARD REMOVED AND STACKED FOOT

ITEM 635.1 HIGHWAY GUARD REMOVED AND DISCARDED FOOT

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

The work under Item 635 shall include removing, transportation, and stacking of the existing steel highway guard.

The work under Item 635.1 shall include the removal and disposal of the cable and post guardrail and the removal and disposal of existing steel highway guard posts and/or panels not suitable for re-use.

The Contractor shall exercise extreme care in the removal, transportation and stacking of the highway guard components to avoid damage. It is assumed that 80% of the existing highway guard is in good condition and should be suitable for stacking. The Contractor shall accept and hold entirely responsibility for the removal, handling and stacking of the existing highway guard and its components. Any portions of the existing highway guard damaged or lost either directly or indirectly as a result of the Contractor's operations shall be replaced by the Contractor at no additional cost to the Owner. The Contractor shall coordinate the stacking of the highway guard with the City prior to and at the completion of the above work. The existing highway guard shall be stacked at Marlborough Department of Public Works, 135 Neil Street.

Method of Measurement

Highway Guard Removed and Stacked and Highway Guard Removed and Discarded will be measured for payment by the foot.

Basis of Payment

Highway Guard Removed and Stacked and Highway Guard Removed and Discarded will be paid for at the respective Contract unit bid prices per foot, which prices shall include all labor, material, tools and equipment, and all incidental cost required to complete the work.

ITEM 697.1 **SILT SACK** **EACH**

Work under this item shall conform to the relevant provisions of Section 670 of the Standard Specifications and the following:

The work under this item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

CONSTRUCTION

Silt sacks shall be installed in retained existing and proposed catch basins, gutter inlets and drop inlets within the project limits and as required by the Resident Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The filter material shall be installed and maintained in accordance with the manufacturer's written literature and as directed by the Engineer.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Owner.

When emptying the silt sack, the contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractors expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

All curb openings shall be blocked to prevent stormwater from bypassing the device.

All debris accumulated in silt sacks shall be handled and disposed of as described in Item 227.3, Removal of Drainage Structure Sediments.

Method of Measurement

Silt sacks will be measured per each, complete in place.

Basis of Payment

Silt sacks will be paid at the Contract unit price per each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 698.1 GEOTEXTILE FABRIC FOR STABILIZATION SQUARE YARD

The work under this item shall consist of placing a geotextile fabric in the construction of slopes greater than 2:1. Locations for slopes greater than 2:1 include, but are not limited to:

STA	TO	STA	Left/Right
20+50		22+50	RT
35+50		39+50	LT
41+50		51+50	LT
51+00		54+00	RT
52+25		54+00	LT

The fabric shall conform to requirements of AASHTO M 288 for stabilization.
Installation will be in conformance with the manufacturer's specifications.

Geotextile fabric will be measured by the square yard of stabilized slope.

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

ITEM 698.2 GEOTEXTILE FABRIC FOR SUBSURFACE DRAINAGE SQUARE YARD

The work under this item shall consist of placing a geotextile fabric in the construction of the stone protection at flared end sections as shown on the plans.

The geotextile fabric shall conform to MassDOT Material Specification M9.50.0 Type IV Fabric.

Geotextile Fabric for Subsurface Drainage will be measured by the square yard complete in place.

Geotextile Fabric For Subsurface Drainage will be paid for at the Contract unit price per square yard, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 698.5 TURF REINFORCING MAT SQUARE YARD

The purpose of this item is to protect slope surfaces with a turf reinforcing mat (TRM) to protect surfaces of soils and ensure germination of seed.

MATERIALS

Substitutions for alternative materials must meet the equivalent specifications, and must be requested in writing for approval by the Engineer.

TRM shall be rolled erosion control product (RECP) composed of non-degradable synthetic fibers, filaments, nets, wire mesh and/or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. The material shall meet the requirements of the Erosion Control Technology Council Standard Specification for Permanent Rolled Erosion Control Products Type 5.B and be designed for use on geotechnically stable slopes with gradients up to 0.5:1 (H:V) and channels with sheer stresses up to 8.0 pounds per square foot.

Anchoring devices shall consist of U-shaped wire staples. Wire shall be a minimum of 8 gauge. All anchors should be 8 to 12 inches. Longer anchors may be necessary for loose soils.

CONSTRUCTION METHODS

Prepare a stable and firm soil surface free of rocks and other obstructions. Apply soil amendments as necessary to prepare seedbed. Place water, and seed in accordance with manufacturer, local/state regulations, or engineer/specifications requirements. Typically, RECPs are unrolled parallel to the primary direction of flow. Ensure the product maintains intimate contact with the soil surface over the entirety of the installation. Do not stretch or allow material to bridge over surface inconsistencies. Staple/stake RECPs to soil such that each staple/stake is flush with underlying soil. Install anchor trenches, seams and terminal ends as specified.

Install RECPs after application of seed, mulches (if necessary) and other necessary soil amendments, unless soil in-filling of the TRM is required. For TRMs with soil in-filling, install TRM, apply seed, and other soil amendments lightly brush or rake 0.3 to 0.7 in. of topsoil into TRM matrix to fill the product thickness. If in-filling with a hydraulically-applied matrix or medium is required; install TRM, then install hydraulically-applied matrix or medium at the manufacturer's suggested application rate.

RECP shall be anchored using an anchor trench as follows: Excavate a 6 in. by 6 in. anchor trench. Extend the upslope terminal end of the RECPs 3 ft. past the anchor trench. Use stakes or staples to fasten the product into the bottom of the anchor trench on 1 ft. centers. Backfill the trench and compact the soil into the anchor trench. Apply seed and any necessary soil amendments to the compacted soil and cover with remaining 1 ft. terminal end of the RECPs. Fold product over compacted soil in anchor trench to overlap downslope material. Secure terminal end of RECPs with a single row of stakes or staples on 1 ft. centers.

ITEM 698.5 (Continued)

Shingle and overlap consecutive seams 2 to 6 in. in the direction of flow. Secure staples through seam at 1 ft. intervals.

Alternate construction methods, if required, must be approved by the Engineer prior to construction.

Before placing erosion control fabric, the subgrade shall be inspected by the Contractor and Engineer to ensure that it has been properly compacted, that it is smooth, without soft areas, voids, obstructions, stones or other foreign matter.

Reseed all backfilled and disturbed areas as directed by the Engineer.

The Contractor shall be responsible for inspecting and repairing material failures, including separation of mat from soil surface, erosion, beneath the surface of the mat, until the slope vegetation has established.

MEASUREMENT

Measurement for ITEM 698.5 TURF REINFORCING MAT shall be per square yard, installed and in place, as measured across the surface of grade, and does not include buried or overlapped portions.

PAYMENT

Payment for ITEM 698.5 TURF REINFORCING MAT shall include all labor and materials including trenching, placement and stapling of erosion control mat as specified above.

ITEM 701.2 CEMENT CONCRETE WHEELCHAIR RAMP SQUARE YARD

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

Cement concrete wheelchair ramps shall be constructed at locations shown on the Plans and in conformance with the Architectural Access Board's Rules and Regulations dated February 23, 1996, as amended and the MassDOT Wheelchair Ramp Standards, as shown in the 2012 Construction Standards. Concrete score lines as specified in Section 701 shall be continuous throughout the wheelchair ramps.

Detectable Tactile warning surface shall conform to the requirements as shown on the MassDOT Construction Standard Detail E 107.6.5R.

No separate payment will be made for the detectable warning panels, but all costs in connection therewith shall be included in the unit price bid.

The cement concrete walk transitions at driveways will be paid for under this item.

ITEM 702. HOT MIX ASPHALT WALK SURFACE TON

The work under this item shall conform to the relevant provisions of Sections 701 of the Standard Specifications, Section 455 Superpave HMA Specifications of Document 00717 and to the following:

The surface course shall be a compacted thickness of 1 inch Superpave Surface Course - 9.5 (SSC-9.5). The intermediate course shall be a compacted thickness of 1 1/2 inches Superpave Intermediate Course - 12.5 (SIC–12.5).

All Superpave HMA mixtures under this item shall be either 50 or 65 gyration mixtures. This item shall not be subject to the Quality Assurance requirements of Section 450 Hot Mix Asphalt Pavement.

Measurement and Payment
Item 702. will be measured and paid as per Subsections 701.80 and 701.81.

ITEM 703. **HOT MIX ASPHALT DRIVEWAY** **TON**

The work under this item shall conform to the relevant provisions of Section 701 of the Standard Specifications, Section 455 Superpave HMA Specifications of Document 00717 and to the following:

The surface course shall be a compacted thickness of 1 1/2 inches Superpave Surface Course - 9.5 (SSC-9.5). The intermediate course shall be a compacted thickness of 2 inches Superpave Intermediate Course - 12.5 (SIC–12.5).

All Superpave HMA mixtures under this item shall be either 50 or 65 gyration mixtures. This item shall not be subject to the Quality Assurance requirements of Section 450 Hot Mix Asphalt Pavement.

Measurement and Payment
Item 703.will be measured and paid as per Subsections 701.80 and 701.81.

ITEM 710.4. **BOUND – PLAIN GRANITE** **EACH**

The work under this item shall conform to the relevant provisions of Section 710 of the Standard Specifications, City of Marlborough Standard's, and to the following:

Bounds shall be granite with dimensions of 6" x 6" x 4'. Bounds shall have a drill hole with a polished top.

Measurement and Payment

Item 710.4 will be paid for by the contract unit price per each which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 756. NPDES STORMWATER POLLUTION PREVENTION PLAN LUMP SUM

This Item addresses the preparation and implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit.

Pursuant to the Federal Clean Water Act, construction activities which disturb one acre or more are required to apply to the U.S. Environmental Protection Agency (EPA) for coverage under the NPDES General Permit for Storm Water Discharges From Construction Activities. On February 16, 2012 (77 FR 12286), EPA issued the final NPDES Construction General Permit (CGP) for construction activity. The 2012 CGP replaces the 2008 CGP (which expired on February 15, 2012), and will provide coverage for eligible new and existing construction projects for a period of five years.

The NPDES CGP requires the submission of a Notice of Intent (NOI) to the U.S. EPA prior to the start of construction (defined as any activity which disturbs land, including clearing and grubbing). There is a fourteen (14) day review period commencing from the date on which EPA enters the Notice into their database. The Contractor is advised that, based on the review of the NOI, EPA may require additional information, including but not limited to, the submission of the Storm Water Pollution Prevention Plan for review. Work may not commence on the project until final authorization has been granted by EPA. Any additional time required by EPA for review of submittals will not constitute a basis for claim of delay.

In addition, if the project discharges to an Outstanding Resource Water, vernal pool, or is within a coastal ACEC as identified by the Massachusetts Department of Environmental Protection (DEP), a separate notification to DEP is required. DEP may also require submission of the Storm Water Pollution Prevention Plan for review and approval. Filing fees associated with the notification to DEP and, if required, the SWPPP filing to DEP shall be paid by the Contractor.

The General Permit also requires the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the afore-mentioned statutes and regulations. The Plan will include the General Permit conditions and detailed descriptions of controls of erosion and sedimentation to be implemented during construction. It is the responsibility of the Contractor to prepare the SWPPP to meet the requirements of the most recently issued CGP. The Contractor shall submit the Plan to the Engineer for approval at least four weeks prior to any site activities. It is the responsibility of the Contractor to be familiar with the General Permit conditions and the conditions of any state Wetlands Protection Act Order, Water Quality Certification, Corps of Engineers Section 404 Permit and other environmental permits applicable to this project and to include in the Stormwater Pollution Prevention Plan the methods and means necessary to comply with applicable conditions of said permits (reference to Part 9.1.1 of the 2012 CGP).

It is the responsibility of the Contractor to complete the SWPPP in accordance with the EPA Construction General Permit, provide all information required, and obtain any and all certifications as required by the Construction General

ITEM 756. (Continued)

Permit. Any amendments to the SWPPP required by site conditions, schedule changes, revised work, construction methodologies, and the like are the responsibility of the Contractor. Amendments will require the approval of the Engineer prior to implementation.

Included in the General Permit conditions is the requirement for inspection of all erosion controls and site conditions on a weekly basis as well as after each incidence of rainfall exceeding 0.25 inches in twenty-four hours. For multi-day storms, EPA requires that an inspection must be performed during or after the first day of the event and after the end of the event. The Contractor shall choose a qualified individual who will be on-site during construction to perform these inspections. The Engineer must approve the contractor's inspector. In addition, if the Engineer determines at any time that the inspector's performance is inadequate, the Contractor shall provide an alternate inspector. Written weekly inspection forms, storm event inspection forms, and Monthly Summary Reports must be completed and provided to the Engineer. Monthly Summary Reports must include a summary of construction activities undertaken during the reporting period, general site conditions, erosion control maintenance and corrective actions taken, the anticipated schedule of construction activities for the next reporting period, any SWPPP amendments, and representative photographs.

The Contractor is responsible for preparation of the Plan, all SWPPP certifications, inspections, reports and any and all corrective actions necessary to comply with the provisions of the General Permit. Work associated with performance of inspections is not included under this Item. The Standard Specifications require adequate erosion control for the duration of the Contract. This Item addresses acceptable completion of the SWPPP, any revisions/amendments required during construction, and preparation of monthly reports. In addition, any erosion controls beyond those specified in bid items elsewhere in this contract which are selected by the Contractor to facilitate and/or address the Contractor's schedule, methods and prosecution of the work shall be considered incidental to this item.

The CGP requires the submission of a Notice of Termination (NOT) from all operators when final stabilization has been achieved, as well as removal and proper disposal of all construction materials, waste and waste handling devices, removal of all equipment and construction vehicles, removal of all temporary stormwater controls, etc. . Approval of final stabilization by the Engineer and confirmation of submission of the NOT will be required prior to submission of the Resident Engineer's Final Estimate. The permittee is required to use EPA's electronic NOI system or "eNOI system" to prepare and submit NOT. The electronic NOT form can be found at www.epa.gov/npdes/stormwater/cgpenoi. If you are given approval by the EPA Regional Office to use a paper NOT, you must complete the form in Appendix K of the 2012 CGP.

ITEM 756. (Continued)

Basis of Payment

Payment for all work under this Item shall be made at the contract unit price, lump sum, which shall include all work detailed above, including Plan preparation, required revisions, revisions/addenda during construction, monthly reports and filing fees.

Payment of fifty (50) % of the contract price shall be made upon acceptance of the Stormwater Pollution Prevention plan. Payment of forty (40) % of the contract price shall be made in equal installments for implementation of the Stormwater Pollution Prevention plan. Payment of the final ten (10) % of the contract price shall be paid upon satisfactory submissions of a Notice of termination (NOT) when final stabilization has been achieved.

ITEM 804.3 **3-INCH ELECTRICAL CONDUIT TYPE NM PLASTIC (UL)** **FOOT**

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

The work shall include the furnishing and installation of 3-inch non-metallic conduit for the traffic signal systems and the rectangular rapid flashing beacon systems in accordance with the plans and as directed by the Engineer.

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

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

Where new conduits are installed in existing grass areas outside the limits of grading, the work shall include the placement of a minimum of 4 inches of loam borrow and seed to restore the disturbed areas to their original condition.

Where conduit is installed in existing sidewalk or paved median areas to remain, the work shall include replacement of the gravel base material and the surface pavement to match preconstruction conditions.

Conduits will be paid for at the Contract unit price per foot, which price shall include sawcutting, excavation, ordinary borrow, warning tape, gravel borrow, sand bedding, all labor, materials, equipment and incidental costs required to complete the work.

ITEM 816.01 TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 1 LUMP SUM

ITEM 816.02 TRAFFIC SIGNAL RECONSTRUCTION LOCATION NO. 2 LUMP SUM

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

The work shall include the furnishing and installation of part or all of the following items: modifying existing traffic signal controller and cabinet assembly; local traffic signal controller; cabinet and foundation; signal posts and foundations; mast arm assemblies with anchor bolts and foundations; signal heads; backplates; vehicle detectors; emergency vehicle preemption; GPS Time Reference Synchronization units; pedestrian signals with countdown timers; audible pedestrian signal (APS) push buttons with signs; all cable and wiring; ground rods, equipment grounding and bonding; pullboxes; loop detector amplifiers; service connection; and all other equipment, materials and incidental costs necessary to provide complete, fully operational traffic control signal systems as specific herein and as shown on the plans. The locations are:

- Location 1 – Simarano Drive at Forest Street (Item 816.01)
- Location 2 – Simarano Drive at Cedar Hill Street/ D'Angelo Drive/ Northboro Road (Item 816.02)

A list of major traffic signal items required at these locations is included on the plans.

Shop Drawings

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

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

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

Existing Installations

Under Item 816.02 the existing signal equipment and conduit shall be retained as indicated on the plans and in accordance with the relevant provisions of Section 815.65.

ITEMS 816.01 and 816.02 (Cont.)

The existing signal installations to be reconstructed/modified under these is Items shall be maintained in operation throughout the construction period and until the new signal is ready for operation. The Contractor may use temporary supports for signal heads as necessary to allow construction activities.

Any temporary installations shall be in conformance with the MUTCD at all times. If an existing signal is to be turned off temporarily to allow controller switch over or rewiring, police detail shall be used to control traffic at the intersection.

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

Modifying Existing Controller and Cabinet

Under Item 816.02 the Contractor shall modify the existing traffic signal controller and perform cabinet work to implement the proposed phasing and timings data shown.

Service Connections

Under Item 816.01 the service connection shown on the plans is approximate only. The Contractor shall determine exact location from the servicing utility, arrange to complete the service connection, and be responsible for all charges incidental thereto. The respective utility company is responsible for making the connection from the respective riser to the overhead wires.
The service connection under Item 816.02 shall be retained.

Flashing Operation

Changes from automatic flashing to stop-and-go operation and from stop-and-go to automatic flashing operation shall occur as set forth in the 2009 MUTCD.

Traffic Signal Equipment

The traffic signal controller unit (CU), malfunction management unit (MMU), detector amplifiers, cabinet power supply, bus interface units (BIUs) and all other ancillary traffic signal control components included in the traffic control cabinet shall comply with the National Electrical Manufacturers Association (NEMA) Standard No. TS 2-1998, Traffic Controller Assemblies with National Transportation Communications for ITS Protocol (NTCIP) Requirements.

ITEMS 816.01 and 816.02 (Cont.)

Traffic Signal Controller

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

The TS 2 Type 1 cabinet shall, at a minimum, meet the requirements of configuration 3 as defined in Table 5-2, "Type 1 Configurations" of the NEMA TS 2 Standard.

The controller unit shall utilize an interface conforming to Subsection 3.3 of the NEMA TS 2 Standard. The controller unit shall utilize an input/output interface conforming to the requirements of Paragraph 3.3.1 for all input/output functions with the Terminals and Facilities (TF), Malfunction Management Unit (MMU), detector rack assemblies and auxiliary devices. The controller unit shall also meet the requirements of Paragraph 3.3.6 "NTCIP Requirements" of the NEMA TS 2 Standard.

The controller unit shall be supplied with Port 1, Port 2, and Port 3 as defined by the requirements of Subsections 3.3.1, 3.3.2, and 3.3.3, respectively.

The controller unit shall be keyboard-entry menu-driven unit with internal time base coordination (future use), emergency preemption, and programmatic capability.

Malfunction Management Unit

The malfunction management unit (MMU) shall comply with Section 4 of the NEMA TS 2 standard. The MMU shall be capable of operating as either a Type 16 with 16 channels (8 vehicle, 4 pedestrian, 4 overlap) or a Type 12 with 12 channels (8 vehicle, 4 overlap). The MMU's supplied shall be configured to operate as Type 16 units.

The MMU's in either the Type 16 or Type 12 configuration shall be capable of operating in a NEMA TS 2 Type 1 cabinet, a NEMA TS 2 Type 2 cabinet, or a NEMA TS 1 cabinet without loss of functionality.

Loop Detector Amplifiers and Rack Assembly

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

ITEMS 816.01 and 816.02 (Cont.)

The loop detector amplifiers shall conform to Subsection 6.5 of the NEMA TS 2 Standard. The loop detector amplifiers supplied shall be a Type C rack, two channel units with delay and extension timing internal to each unit's channel, as defined in Table 6-1 of the NEMA TS 2 Standard. **(Note: Delay and/or extension timings shall be programmed in the controller and not on the detector amplifiers).** The two channel card rack loop amplifier units shall occupy one of the rack slots in the assembly.

The detector unit shall be capable of operating in a voltage range from 10.8 to 26.5 VDC. The unit shall operate from the cabinet's external power supply at 12 VDC.

The front portion of the detector rack shall be provided with a marker strip to allow identification of detector phase assignments. In addition to the required marker strip, the Contractor shall supply and install on the upper left hand corner of the back of the cabinet door a laminated, pictoral diagram depicting the traffic detector amplifier channel assignments. The assignment information contained shall include approach name, phase, detector number and terminal numbers.

GPS Time Reference Synchronization Units

The Contractor shall supply and install a GPS Time Reference Synchronization Unit in each of the controller cabinets. These devices will be used specifically for keeping the local controller time clocks accurate for use in the future for time based coordination.

The GPS Time Reference Units shall consist of two basic components. The first component is the GPS receiver itself. The GPS receiver shall be mounted to the top of the traffic signal control cabinets with all mounting holes sealed with weatherproof caulking.

The second component is the GPS time reference device. The GPS receiver shall be connected to the GPS time reference device via a serial cable. The GPS time reference device shall be mounted inside the traffic control cabinets on either of the side walls of the cabinets. The GPS time reference device shall be initially programmed with current time zone, time of day to reset clock, and which day(s) to reset the clock. The GPS time reference unit shall initially be programmed to output the time once a day on every day of the week. At this specific time, the GPS time reference device will provide an output (contact closure) to reset the controller time. The controllers shall be initially programmed to allow a contact closure to reset the time clock once per day.

The installation of GPS time reference unit shall include all necessary wiring, additional Bus Interface Units (BIUs), and programming to ensure a fully operating system.

The cabinet documentation (box prints) shall show all wiring between the GPS time reference unit and the control cabinets. This documentation shall include all programming in the local controllers.

ITEMS 816.01 and 816.02 (Cont.)

Vehicle Loop Detectors

Wire loop detectors shall be installed in the roadway for vehicle detection. In advance of the loop detector installation, the Contractor shall mark, on site, the loop detectors with any changes required by field conditions such as manholes. The loop detector layout shall be inspected and approved by the Engineer before the loop detectors are installed.

Loop wire shall be encased in a protected plastic tubing of PVC or polyethylene plastic, IMSA 51-5, 0.25 inches outside diameter, and the wire may have cross-linked polyethylene insulation or it may have THHN/THWN insulation.

Splicing insulator shall be an approved re-enterable rigid body splice kit with a non-hardening sealing compound compatible with the wire insulation.

Splice and Connection: Splicing and connection shall be made in the pull box nearest the roadway loop sensor but not exceeding four loops per pull box. All loops included in a detector group as shown on the plans shall be spliced in a single pull box. Each lead and lead-in connector shall be stripped back and spliced using a pressure type wire connector applied with a crimping tool. Multiple loop sensors shall be identified as detailed on the plans.

Lead-in splicing shall be staggered to prevent contact with each other. Each crimped splice shall be soldered and insulated. The insulation material shall be heat-shrinked polyolefin. The shielded lead-in cable outer jacket and shield shall be stripped back sufficiently to ensure that the shield cannot come into contact with the spliced conductors. Follow the instructions of the kit manufacturer for this procedure when installing the re-enterable splice kit.

NOTE WELL: The above splice shall be done on the day of the loop wire installation to prevent the entrance of any moisture into the plastic tubing.

The lead-in conductors shall be connected to the appropriate terminals in the controller cabinet, by using crimped or soldered terminal ends. The heat source for soldering shall be electrical not exceeding 30W capacity.

Testing of Loops: The following test procedure shall be performed in the presence of the Engineer before and after the loop sensor is sealed in the pavement as detailed below. The cost of equipment, labor, and materials to perform such testing and similar re-testing following repairs, replacement, or adjustment of any detector within the project area shall be included in the contract unit prices.

After installation of wire loop sensors in the roadway and installation of shielded lead-in connecting the loop sensors to the controller cabinet each loop sensor and lead-in combination shall be tested (at the controller cabinet) for proper installation. The resistance from lead to lead of the same loop shall not exceed three (3) ohms per one thousand (1,000) feet as measured by a high quality meter suitable for measurements of low resistance in the range of 1 to 6 ohms.

ITEMS 816.01 and 816.02 (Cont.)

A megohm meter test at 500 volts DC shall be made between the two leads of a loop/lead-in combination temporarily spliced together, but otherwise disconnected from all terminals, and the shield drain wire and the earth ground connection. These resistances shall be at least one hundred (100) megohms.

A megohm meter test at 500 volts DC shall be made between lead-in shield and the earth ground rod. This resistance shall be at least one hundred (100) megohms.

The meter used for these tests shall be checked for calibration each day of use by using a resistor block of ±5% resistors simulating loads of 1 megohm, 20 megohm and 100 megohms. The observed meter reading shall be ±10% of the nominal resistor load.

If any loop sensor and lead-in combination fails to pass any one of the four (4) tests, it shall be repaired and then re-tested on two occasions at least two (2) weeks apart, and then shall pass on each re-test occasion. If the loop sensor lead-in combination does not pass all these re-tests, a new loop sensor and/or lead-in shall be installed, and shall pass these tests, at no additional cost.

After the above tests have been satisfactorily completed, all loop sensor/shielded lead-in inductances shall be measured and a written report of the results shall be filed with the Engineer and a copy stored with the "box prints" at the intersection.

Cabinet Power Supply

A separate power supply shall be supplied and installed in each of the TS 2 cabinets. As a minimum, the power supply shall meet all requirements of Paragraph 5.3.5 of the NEMA TS 2 Standard. The unit shall be AC line powered and provide regulated DC power, unregulated AC power, a line frequency reference for the rack mounted loop amplifiers, bus interface units, load switches and other auxiliary cabinet equipment as required.

The power supply shall be either shelf mounted or installed as part of the loop detector rack assembly.

The unit shall contain four LED indicators on the front panel to indicate the four outputs;
1. + 12 VDC +/- 1 VDC @ 2.0 amps,
2. + 24 VDC +/- 2 VDC @ 2.0 amps,
3. 12 VAC @ 250 milliamps, and
4. 60 Hz line frequency reference.

A test point terminal shall also be located on the units front panel for + 24VDC and logic ground testing.

ITEMS 816.01 and 816.02 (Cont.)

Load Switches

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

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

Flasher

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

Flash Transfer Relays

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

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

Traffic Controller Cabinet

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

TS 2 Type 1 Configuration Table

Item Number	NEMA TS 2 Cabinet Size	Nominal Cabinet Size (HxWxD)*	Configuration Type Table 5-2	Load Switch Positions	Flash Transfer Relays	BIUs Required	Detector Rack Type Table 5-9	MMU (Channels)
816.01	6	52x44x24	3	12	6	3	2	16 Channel

*** Approximate cabinet dimensions are provided in inches.**

Cabinet shall be made of aluminum**. The cabinet shall be equipped with two (2) fans for forced air cooling.**

The cabinet shall be installed with the door opening positioned in order to allow general observation of the flow of traffic and the inside of the cabinet at the same time.

ITEMS 816.01 and 816.02 (Cont.)

Surge Suppression

The Contractor, under Item 816.01, shall supply and install surge suppression in the traffic controller cabinet in accordance with MassDOT Standards. At a minimum surge suppression shall be provided for all loop detectors, power service, and emergency preemption.

Spare Equipment

The Contractor shall provide the following spare signal equipment in the proposed traffic signal controller cabinet as follows:

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

Bus Interface Units

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

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

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

Testing of Grounding System

The Contractor shall perform testing of the equipment grounding system in the presence of the Engineer in accordance with MassDOT Standard Specifications.

ITEMS 816.01 and 816.02 (Cont.)

Emergency Preemption

The emergency vehicle preemption system shall be installed in the same cabinet as the controller. The make and model of the preemption system for this project shall meet the approval of the City of Marlborough.

The emergency vehicle preemption control system shall consist of a data-encoded phase selector to be installed within the traffic control cabinet. This unit will serve to validate, identify, classify, and record the signal from the optical detectors located on support structures at the intersection. Upon receiving a valid signal from the detector, the phase selector shall generate a preempt call to the controller initiating a preemption operation as shown on the plans.

The optical detectors shall be single input, single output units used to control one approach. All traffic signal installations shall be supplied with a minimum of two optical detectors unless otherwise noted in the major items list.

The phase selector shall be a rack-mounted plug-in, dual priority device. The phase selector shall plug into a shelf-mounted single card slot chassis. Programming the phase selector shall be via a PC-based computer utilizing unit specific software. One copy of software, on a CD shall be supplied and licensed to the City of Marlborough. A hard copy of final programming data shall be left in the control cabinet. The Contractor shall supply a complete set of interface cables for phase selector to laptop connection.

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

The Contractor shall be responsible for the proper programming of the phase selector, orientation of the optical detectors, and all other work necessary to provide a complete and operating emergency vehicle preemption system. The Contractor may be required to field adjust the location of the optical detectors in the presence of the Engineer to properly detect preemption calls from approaching vehicles.

Mast Arms (45-Foot and smaller), Poles and Foundations

Mast arm poles shall be fabricated and constructed in conformance with the MassDOT Standard Drawings included in the plans and as stated below.

All mast arm poles shall be **Type 2, Heavy Load,** galvanized steel monolevers with shoe bases.

Acceptance of Type 2 mast arm poles will be contingent upon review and approval of shop drawings submitted by the Contractor. Longhand design calculations shall be submitted by the Contractor with the shop drawings for all Type 2 mast arm poles.

ITEMS 816.01 and 816.02 (Cont.)

The Contractor shall provide a set of calculations, stamped by a Structural Engineer registered in the Commonwealth of Massachusetts, along with plans and specifications for review by the Engineer.

All mast arm pole foundations shall be cored pier foundations and constructed with **heavy loading conditions** in conformance with MassDOT Standard Drawings included in the plans and priced per Table 2 provided below.

TABLE 2

MAST ARM NO.	ARM LENGTH	STA.	OFFSET	SOIL TYPE	FOUND. DIA.	FOUND. DEPTH	VERT. BARS
Item 816.01							
1	25’	14+92.5	26.0’ LT	Wet Sand	4”-0”	12’-0”	23-#10
2	35’	15+89.5	49.5’ LT	Wet Sand	4’-6”	13’-0”	23-#10
3	30’	16+21.0	35.5’ RT	Wet Sand	4’-0”	12’-0”	23-#10
4	25’	14+93.0	31.0’ RT	Wet Sand	4’-0”	12’-0”	23-#10

Where applicable the Contractor shall install non-shrink grout, with provisions for weep hole(s), between the bottom on the mast arm pole bases and the top of the foundations. The grout shall be flush with the pole bases. The diameter of the weep hole(s) shall be meet the requirement of MassDOT.

No separate payment will be made for work considered incidental to the excavation, including but not limited to, mast arm foundations, dewatering, etc. but all costs in connection therewith shall be included in the various contract items.

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

ITEMS 816.01 and 816.02 (Cont.)

Signal Heads

Signal heads mounted on mast arms shall be rigidly attached to the mast arms. All signal heads mounted overhead on mast arms shall be installed, with the bottom of the signals at the same height. All traffic signal lenses shall be 12 inches in diameter unless otherwise noted on the plans. Five inch louvered backplates and tunnel visors shall be provided on all signal heads as noted on the plans. All signal heads shall be equipped with ball and/or arrow light emitting diode (LED) modules.

Red, Yellow, And Green LED Vehicle Signal Module

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

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

All Red and Green Light Emitting Diode (LED) signal module shall conform to "Interim LED Purchase Specification of the Institute of Transportation Engineers, Vehicle Traffic Control Signal Heads - Part 2: Light Emitting Diode (LED) Vehicle Traffic Signal Modules", July 1998 Version or most current version, Institute of Transportation Engineers (ITE), 1627 Eye Street NW, Washington, DC 20006, Telephone: (202) 785-0060, FAX: (202) 785-0609.

Yellow LED signal modules shall conform to the above specifications with the exception that yellow modules shall meet maintained Minimum Luminous Intensity values of Table 1, Section 4 of the above referenced ITE specification of compliant green signal modules at 77 degrees Fahrenheit at 120 volts AC, throughout the useful life based on normal use in traffic signal operation over the operating temperature range.

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

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

LED signal modules must be type tested and be on MassDOT's Approved Equipment List.

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

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

ITEMS 816.01 and 816.02 (Cont.)

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

Optical and Light Output Requirement: The minimum luminous intensity values and light output shall be maintained within the rated input voltage of 117 Volts AC. LED signal modules shall not be allowed to fall short of the minimum intensity values at any of the 44 measuring points of the standard when lamp is turned on cold for measurements and after a 30 minute warm-up time period at 100% duty cycle.

Electrical: The maximum wattage for 12 inch ball shall be 20 Watts and 10 Watts for the 12 inch arrow. The LED sources shall not be powered above 70% of the manufacturer's specified rated load. This shall be clearly shown in layman's terms through calculations, schematics, catalogue cuts, etc.

The LED sources shall be made of the AlInGap type shown clearly in a catalogue cut or similar literature.

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

The LED signal module will be replaced or repaired by the manufacturer if it exhibits either a greater than 40 percent light output degradation or a fall below the minimum intensity levels within the first 36 months of field operation.

Pedestrian Heads with Countdown Timers

Pedestrian heads shall be 16 inch pedestrian signal with countdown timer and cap visors. Pedestrian head indications shall be illuminated L.E.D. type displaying the graphical symbols of a walking person and/or upraised hand. The internal countdown module shall consist of two 7-segment digits, 7 inch high. The countdown module shall display the number of seconds remaining throughout the pedestrian "WALK" interval, continue counting down through the flashing "DON'T WALK" interval, and blank out during the steady "DON'T WALK" interval. The countdown module shall be automatically set by the intersection controller based upon the "WALK" and "DON'T WALK" signal intervals only.

ITEMS 816.01 and 816.02 (Cont.)

The countdown module shall continuously monitor the intersection controller for any changes to the pedestrian phase timing, and reprogram itself automatically. All LED indications on the pedestrian signal shall have an automatic dimming circuit for night illumination to reduce long-term degradation to the LEDs.

Accessible Pedestrian Signal Pushbuttons

The Accessible Pedestrian Signal (APS) pushbuttons shall provide information in non-visual formats (such as audible tones, speech messages, and/or vibrating surfaces). The APS pushbuttons and shall be compliant with the 2009 MUTCD. At a minimum the APS pushbuttons shall be provide with the following features:

- Pushbutton locator tone
- A visible and audible indicator that the button press has occurred
- A vibro-tactile arrow
- An audible walk indication

The APS pushbuttons shall provide visually disabled pedestrians with a locator tone that will allow them to find the pushbutton to activate the walk signal. Once the pushbutton call has been placed, the signal will provide both an audible and tactile response during the related "WALK" portion of the cycle. A sunlight visible LED latches "ON" to confirm the button has been pushed. The audible response shall be a speech message, indicating the name of the street crossing, and when the phase is started.

Housing and Pushbutton Unit – Shall meet the following minimum requirements:

- Constructed of cast aluminum with a powder coated finish.
- Highly vandal resistant and pressure activated with essentially no moving parts.
- Pushbutton must be able to withstand an impact from a baseball bat or hammer.
- Operating temperature range -34 degrees Celsius to 65 degrees Celsius.
- Operating voltage range 12 to 36 VDC.
- Button cap must be made of solid 316 stainless steel.
- Pushbutton must activate with 5 lbs of force or less.
- Unit must have an LED display to give indication that of pushbutton being pushed.
- Pushbutton must fully operate immediately after being completely immersed in water for 5 minutes (electrical terminals isolated from water).
- Pushbutton must not allow ice to form such that it would impede function of pushbutton or pushbutton cap.
- All switch electronics must be sealed within the housing.
- All sounds shall emanate from the back of the of the APS pushbutton unit via a weatherproof speaker that is protected by a vandal resistant screen.

ITEMS 816.01 and 816.02 (Cont.)

Tactile Arrows and Locator Tones – Shall meet the following minimum requirements:

- APS pushbuttons shall incorporate a locator tone at the pushbutton the locator tone, measured at 3 feet from the APS pushbutton, shall be 2dB minimum and 5dB maximum above ambient noise level in standard operation and shall be responsive to ambient noise level changes. Tones shall consist of multiple frequencies with a dominant component of 880Hz. The duration of the locator tone shall be 0.15s and shall repeat at intervals of 0.15s.

- APS pushbuttons shall be a minimum of 2 inches across in diameter and shall contract visually with their housing and mounting.

- APS pushbuttons shall include a vibro-tactile arrow aligned parallel to the crosswalk direction. The arrow shall be raised 0.03 inches minimum and shall be 1.5 inches minimum in length. The arrow head shall be open at 45 degrees to the shaft and shall be 33 percent of the length of the shaft. Stroke width shall be 10 percent minimum and 15 percent maximum of arrow length. The arrow shall contrast with the background.

- The arrow shall vibrate during the "WALK" portion of the cycle.

Audible Walk Indication – shall be a percussion tone and shall repeat at eight to ten ticks per second.

Mounting Requirements - A maximum mounting height of 42 inches above the finish sidewalk grade shall be used for APS pedestrian pushbuttons.

The Contractor is hereby notified that they are ultimately responsible for constructing all pedestrian push button elements (clear ground space, forward and side arm reaches) in strict compliance with the current AAB rules, regulations and standards.

All construction elements in this project associated with pedestrian push buttons are controlled by 521CMR – Rules and Regulations of the Architectural Access Board.

The Contractor shall establish clear ground space at all pedestrian push button locations, and shall set arm reach lengths according to the AAB rules (or to the details shown on the plans).

The project has been designed to conform to all AAB rules, and the Engineer is not aware of any required variances for the work presented on the design plans. The Contractor shall notify the Engineer of any project element related to the pedestrian push buttons that will not comply with 521 CMR prior to constructing said pedestrian push button elements.

ITEMS 816.01 and 816.02 (Cont.)

Installation - The APS pushbuttons shall be installed by Contractor and as recommended by the manufacturer and documented in installation materials provided by the manufacturer. The Contractor shall be responsible for the proper programming of the APS pushbuttons, orientation of the pushbuttons, and all other work necessary to provide a complete and operational APS pushbutton system. The Contractor may be required to adjust volume levels as directed by the Engineer. When the setup is complete and the APS pushbuttons are ready for operation, the values of all parameters that were set during the process shall be delivered to the Engineer in printed and computer-readable form.

Warranty - Each APS pushbutton shall be warranted free from defects in material and workmanship for a period of at least 2 years from the date of installation by the Contractor and acceptance from the owner.

During the warranty period, technical support shall be available from the supplier to the owner via telephone within 4 hours of the time a call is made by a user, and this support shall be available from factory-certified personnel without charge.

Posts and Bases

Signal posts and bases shall be aluminum shafts with cast aluminum transformer bases.

Signal base foundations shall not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons is impaired.

Software

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

Data Base Programming

Each programmable local hardware component (controller, malfunction management unit, preemption unit, and detector amplifier) shall be initially programmed by the Contractor based on information contained on the plans. Three sets of hard copy programming per device shall be supplied by the Contractor.

The Contractor shall supply an 8½”x17” laminated copy of the traffic signal design plans and sequence and timing chart to be left in the cabinet’s documentation envelope mounted on the inside of the cabinet door.

ITEMS 816.01 and 816.02 (Cont.)

Equipment Finish and Color

Traffic signal equipment including but not limited to signal posts, bases, signal heads, visors (outside), doors, mast arms, controller cabinet (exterior); pushbutton saddles, service meter socket boxes, optical preemption detectors, hardware, and rigid mounting brackets for signals and signs shall be colored **BLACK,** subject to the approval of the City of Marlborough. The Contractor shall submit to the Engineer, and the City for approval, paint chips and sample finishes on steel and aluminum of the intended color prior to any work being done under this heading.

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

Steel Equipment

Galvanizing

All bolts, screws, nuts, rods and washers shall be galvanized in accordance with AASHTO M232 and the Standard Specifications. The hardened machine screws
may be electroplate galvanized. Stainless steel studs, bolts, screws, nuts, straps and washers shall not be galvanized. Galvanized hardware need not be painted; however, the ends of bolts, nuts, and washers shall be painted in the field according to section "Touch-up and Repairs." Immediately prior to galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The dry kettle galvanizing process shall be used.

All steel components, other than above, shall be galvanized after fabrication in accordance with AASHTO M111. The galvanizing bath shall contain nickel (0.05% to 0.09% by weight). Galvanized members requiring shop assembly shall be welded and drilled prior to galvanizing.

Coating Over Galvanized Steel

Prior to painting, the applicator shall ensure that all components are smooth and without sharp protrusions that would present and injury hazard to pedestrians. Also, the fabricator shall ensure that all welds shall be cleaned thoroughly in accordance with good practice and according to AWD D1.5 and ASTM A123-89a and shall have a suitable surface to accept the galvanizing.

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

ITEMS 816.01 and 816.02 (Cont.)

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

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

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

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

The color shall be **BLACK**. The fabricator shall submit to the Engineer for approval, paint chips of the intended color prior to any work being done under this heading.

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

Air Temperature	50°F min.,	90°F max.
Surface Temperature	50°F min.,	100°F max.

Surface temperature must be at least 5°F above the dew point.

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

Touch-up and Repairs

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

Touch-up of galvanizing before the finish coat is applied shall be accomplished by applying galvanizing repair paint. The dry film thickness of the applied repair paint shall not be less than 4.0 mils.

Applications shall be in accordance with the manufacturer's instruction.

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

ITEMS 816.01 and 816.02 (Cont.)

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

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

Aluminum Equipment

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

Quality	Test	Limits
Abrasion	Taber abraser CS-10, 1000 gram load, 1000 cycle, ASTM D4060	100 mg. Maximum weight loss
Adhesion	ASTM D .59 Initial 1000 hours	 5A 5A
Gloss	ASTM D 523 60° - 600 hours 60° - 1000 hours	 82% retention 90% retention (washed)
Hardness	ASTM D 3363	2H – No Gouge
Impact	ASTM D 2794 Direct	Pass 80 inch-lb.
Salt Spray Resistance	ASTM B 177 ASTM D 1654 1000 hours unscribed 400 hours scribed	 Table 2-10 Table 1-10
Weather Resistant	ASTM G 23, 1000 hours, 18 min. waterspray, 102 min. light	No film failure
Color	**Black**	
Identify	Infrared fingerprint	Match
Flexibility	180° bend; ½" dia, mandrel within 10 seconds	No breaks, flaking or cracks. Tested with a Q-panel with 2 mils or less of coating
Humidity	ASTM D 2247, 1000 hours	No blister or film failure
Thickness		4 mils +/- 1 mils
Mar Resistance		Good

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

ITEMS 816.01 and 816.02 (Cont.)

Basis of Payment

The work under Items 816.01 and 816.02 will be paid for at the respective Contract lump sum prices, which prices shall include all labor, material, equipment and incidental costs required to complete the work.

No separate payment will be made for maintenance of existing installation, but all costs in connection therewith shall be included in the lump sum prices bid for Items 816.01 and 816.02.

Conduit will be paid for separately under Item 804.3, 3 Inch Electrical Conduit Type NM Plastic (UL).

ITEM 824.401 RECTANGULAR RAPID FLASHING BEACON SYSTEM LUMP SUM
LOCATION NO. 1

ITEM 824.402 RECTANGULAR RAPID FLASHING BEACON SYSTEM LUMP SUM
LOCATION NO. 2

Work under these Items shall conform to the relevant provisions of Section 800 of the Standard Specifications, the 2009 Manual on Uniform Traffic Control Devices (MUTCD), and the following:

The work shall include the furnishing and installation of part or all of the following items: side of post/pole mounted control cabinet; signal posts and foundations; mast arm assemblies with anchor bolts and foundations; rectangular rapid flashing beacons (RRFB); infrared pedestrian detection system; pull boxes; service connections; all cable and wiring; ground rods, equipment grounding and bonding; and all other equipment, materials and incidental costs necessary to provide complete, fully operational rectangular rapid flashing beacon systems as specific herein and as shown on the plans. The locations are:

- Location 1 – Simarano Drive at Campus Drive (Item 824.401)
- Location 2 – Simarano Drive at Value Way (Item 824.402)

A list of major items required for the RRFB systems are included on the plans.

Shop Drawings

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

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

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

Service Connections

Under these Items the service connections shown on the plans are approximate only. The Contractor shall determine exact locations from the servicing utility, arrange to complete the service connections, and be responsible for all charges incidental thereto.

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

ITEMS 824.401 and 824.402 (Cont.)

Equipment Bonding

Special purpose bonding wire shall be No. 8 AWG or larger conforming to the requirements of ASTM B-3.

Rectangular Rapid Flashing Beacon (RRFB)

General Requirements:

- The RRFBs shall consist of one-sided, two-sided, or three-sided units with rapidly and alternately flashing rectangular yellow indications having LED-array based pulsing light sources, and shall be designed, located, and operated with the detailed requirements specified herein and on the plans. The RRFBs shall have indications (2 per side) and shall be visible to vehicles in both directions. The two and three sided units shall have one indication visible to pedestrians in crosswalks to give confirmation that the RRFB is in operation.

- Each LED-array, for vehicles, shall be a minimum of approximately 5 inches wide by approximately 2 inches high.

- The front of each RRFB unit shall be approximately 22 inches wide by approximately 4 inches high.

- Each RRFB shall be located between the bottom of the W11-2 sign and the top of the supplemental downward diagonal arrow sign (W16-7p) unless otherwise noted on the plans.

Beacon Flashing Requirements:

- When activated, the RRFB indications shall flash in a rapidly alternating “wig-wag” flashing sequence (left light on, then right light on).

- As a specific exception to the 2009 MUTCD Section 4L.01 requirements for the flash rate of beacons, RRFBs shall have a much faster flash rate. Each of the yellow indications of an RRFB shall have 70 to 80 periods of flashing per minute and shall have alternating but approximately equal periods of rapid pulsing light emissions and dark operation. During each of its 70 to 80 flashing periods per minute, the yellow indication on the left side of the RRFB shall emit two slow pulses of light after which the yellow indications on the right shall emit four rapid pulses of light followed by a long pulse.

- The flash rate of each individual yellow indication, as applied over the full on-off sequence of a flashing period of the indication, shall not be between 5 and 30 flashes per second, to avoid frequencies that might cause seizures.

ITEMS 824.401 and 824.402 (Cont.)

- The light intensity of the yellow indications shall meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005.

Beacon Operation:

- The RRFBs, normally dark, shall initiate operation passively via an infrared pedestrian detection system each and every time that a pedestrian is detected, and shall cease operation at a predetermined time limit. This time limit shall be initially set as noted on the plans. The following example is provided to clarify this operation:

  If the predetermined flash period is set for 20 seconds and a new actuation is received when the RRFBs have already been flashing for 12 seconds, a new 20-second period will immediately commence, thus resulting in a continuous flashing duration of 32 seconds. If the predetermined flash period is set for 20 seconds and a new actuation is received 1 second after the RRFBs have ceased flashing, a new 20-second period will immediately commence, thus resulting in a flashing duration of 41 seconds with a 1-second interruption.

- All RRFBs associated with a given crosswalk shall, when activated, simultaneously commence operation of their alternating rapid flashing indications and shall cease operation simultaneously.

Infrared Pedestrian Detection System

The RRFBs shall be activated by infrared pedestrian detection system as shown on the plans. The amount of time that the RRFBs remain activated by the pedestrian detection system shall be user programmable from 0 to 60 seconds. The infrared pedestrian detection system shall support a stable detection process capable of detecting pedestrians both day and night (total darkness). The infrared pedestrian detection system shall be user adjustable, environmentally secure, and vandal resistant. The units shall also be insensitive to temperature, humidity, color, or background noise.

The infrared pedestrian detection system shall detect and monitor pedestrians utilizing pedestrian detection algorithms using stereo vision analysis to supply accurate and consistent detection.

ITEMS 824.401 and 824.402 (Cont.)

Major components of the infrared pedestrian detection system shall consist of a high resolution infrared LED stereo cameras, high performance single board computer, control cabinet, and cables. The infrared pedestrian detection system shall meet the following minimum requirements:

- Image Sensor – 1/3" CCD Chip
- Camera Horizontal Resolution - 600 TV lines
- Camera Dimensions – approximately 4"H x 7"W x 5"L
- Camera Mounting Height – 10 to 15 feet
- Adjustable detection pattern zones
- Activation Time - 1 to 5 seconds
- IR Range – approximately 100 feet in total darkness
- Relay Output – 0 to 30V DC
- S/N Ratio - $\geq$ 48 dB
- 110 VAC 60Hz Input Power From External Source
- Operating Temperature Range From -22° F to +158° F
- Operating Humidity – 0 to 96 percent
- Operating Environment – All weather, day and night
- Single Board Chassis Computer w/ RJ-45 connections - approximately 2"H x 6.5"W x 8"L
- Control Cabinet - Side-of-pole mounted aluminum cabinet (nominal 20"H x 17"W x 15" D), with a minimum NEMA 3R rating
- Control Cabinet Lock – Industrial, standard pin tumbler lock with two #2 keys
- Cable – CAT5e
- Camera Mounting Hardware, allowing full pan and tilt adjustment

The Single Board Computer, running Windows XPe, shall include a pre-installed software configurator that can be used to configure the detection zones. For the configuration a laptop or notebook shall be used to access the Single Board Computer. The infrared pedestrian detection system shall include all necessary software and hardware to allow the end user to program, setup, and/or modify detection zones.

One portable 7" color monitor and one stylus, for future viewing of the detection images, shall be supplied by the Contractor to the City. The Contractor shall also supply any necessary cables, and interface devices for monitoring detection via laptop computers.

The infrared pedestrian detection system shall be installed by the Contractor in accordance with the manufacturer's recommended procedure for installation.

The infrared pedestrian system shall be supplied with two external operations timers. Both timers shall be digital and settable from 0 to 999 seconds in one second increments. The timers shall be installed such that the front display is visible from the front of the cabinet and the timing adjustments are accessible for servicing. Each timer and timer base shall be labeled as to function.

ITEMS 824.401 and 824.402 (Cont.)

- Duration – This timer shall control the amount of time, in seconds, that the RFFB is active after a valid pedestrian call has dropped. The timer shall automatically reset upon deactivation. This timer shall be initially set to the time noted on the plans.

- Lock-out – This timer shall control the amount of time between activation of the RFFB via pedestrian calls. This timer shall be initially set for 0 seconds.

The infrared pedestrian detection system shall be programmed and wired to provide failsafe operation. In the event of system failure, such as detection failure, a constant pedestrian call will be placed to the RRFB.

The Contractor shall be responsible for the proper programming of the infrared pedestrian detection system, orientation of the associated cameras, and all other work necessary to provide a complete pedestrian detection system. The Contractor may be required to field adjust the location of the cameras and/or detection zones in the presence of the Engineer to properly detect pedestrians.

The cabinet documentation (box prints) shall show all wiring between infrared pedestrian detection system, the RRFBs and the control cabinet.

Warranty - The supplier shall provide a two-year warranty on the infrared pedestrian detection system following installation and warranty registration.

Training - The Contractor shall provide up to two (2) hours of personnel training in the use of the infrared pedestrian detection system and software. This training is to be conducted with the City. The Contractor is to coordinate with the City as to the exact location and time of the training. It is the responsibility of the Contractor to provide training manuals, class notes, and other instructional materials for up to four attendees at the training sessions. No training shall begin unless and until the final inspection process indicates, in the opinion of the Engineer, that the infrared pedestrian detection system is sufficiently complete and operational such that training would be useful at the time.

Mast Arm, Pole and Foundation

The mast arm pole shall be fabricated and constructed in conformance with the MassDOT Standard Drawings included in the plans and as stated below.

Thel mast arm pole shall be **Type 2, Heavy Load,** galvanized steel monolever with shoe base.

Acceptance of Type 2 mast arm pole will be contingent upon review and approval of shop drawings submitted by the Contractor. Longhand design calculations shall be submitted by the Contractor with the shop drawings for the Type 2 mast arm pole.

ITEMS 824.401 and 824.402 (Cont.)

The Contractor shall provide a set of calculations, stamped by a Structural Engineer registered in the Commonwealth of Massachusetts, along with plans and specifications for review by the Engineer.

The mast arm pole foundation shall be cored pier foundations and constructed with **heavy loading conditions** in conformance with MassDOT Standard Drawings included in the plans and priced per Table 2 provided below.

TABLE 2

MAST ARM NO.	ARM LENGTH	STA.	OFFSET	SOIL TYPE	FOUND. DIA.	FOUND. DEPTH	VERT. BARS
Item 824.402							
1	35’	51+15.0	32.0’ LT	Alluvial	4’-6”	18’-0”	23-#10

Where applicable the Contractor shall install non-shrink grout, with provisions for weep hole(s), between the bottom on the mast arm pole base and the top of the foundation. The grout shall be flush with the pole base. The diameter of the weep hole(s) shall be meet the requirement of MassDOT.

No separate payment will be made for work considered incidental to the excavation, including but not limited to, mast arm foundation, dewatering, etc. but all costs in connection therewith shall be included in the various contract item.

The foundation shall not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons is not impaired.

Posts and Bases

Signal posts shall be steel shafts with transformer bases.

Signal base foundations shall not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons is impaired.

System Documentation

The Contractor shall submit to the Engineer two (2) copies of the operating and maintenance instructions for all equipment complete in wiring diagram of the internal, external and field connections of all equipment the Contractor has installed on the project.

ITEMS 824.401 and 824.402 (Cont.)

Wiring Diagram

Two sets of wiring diagrams with both internal and external wiring for the control cabinet and all accessories as actually used in the field shall be furnished to the Owner. All actual and potential terminal strip connections shall be shown. All identification on the diagrams shall be as installed, and all field labeling shall be consistent with the diagram.

Manuals and Keys

The Contractor shall supply two (2) copies of operating and maintenance manuals and two (2) sets of cabinet keys to the Owner.

Equipment Finish and Color

Beacon equipment including but not limited to signal posts, bases, mast arms, controller cabinets (exterior); service meter socket boxes, hardware, and rigid mounting brackets for the beacons and signs shall be colored **BLACK,** subject to the approval of the City of Marlborough. The Contractor shall submit to the Engineer, and the City for approval, paint chips and sample finishes on steel and aluminum of the intended color prior to any work being done under this heading.

Steel Equipment

Galvanizing

All bolts, screws, nuts, rods and washers shall be galvanized in accordance with AASHTO M232 and the Standard Specifications. The hardened machine screws
may be electroplate galvanized. Stainless steel studs, bolts, screws, nuts, straps and washers shall not be galvanized. Galvanized hardware need not be painted; however, the ends of bolts, nuts, and washers shall be painted in the field according to section "Touch-up and Repairs." Immediately prior to galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The dry kettle galvanizing process shall be used.

All steel components, other than above, shall be galvanized after fabrication in accordance with AASHTO M111. The galvanizing bath shall contain nickel (0.05% to 0.09% by weight). Galvanized members requiring shop assembly shall be welded and drilled prior to galvanizing.

Coating Over Galvanized Steel

Prior to painting, the applicator shall ensure that all components are smooth and without sharp protrusions that would present and injury hazard to pedestrians. Also, the fabricator shall ensure that all welds shall be cleaned thoroughly in accordance with good practice and according to AWD D1.5 and ASTM A123-89a and shall have a suitable surface to accept the galvanizing.

ITEMS 824.401 and 824.402 (Cont.)

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

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

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

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

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

The color shall be **BLACK**. The fabricator shall submit to the Engineer for approval, paint chips of the intended color prior to any work being done under this heading.

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

Air Temperature	50°F min.,	90°F max.
Surface Temperature	50°F min.,	100°F max.

Surface temperature must be at least 5°F above the dew point.

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

Touch-up and Repairs

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

Touch-up of galvanizing before the finish coat is applied shall be accomplished by applying galvanizing repair paint. The dry film thickness of the applied repair paint shall not be less than 4.0 mils.

Applications shall be in accordance with the manufacturer's instruction.

ITEMS 824.401 and 824.402 (Cont.)

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

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

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

Aluminum Equipment

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

Quality	Test	Limits
Abrasion	Taber abraser CS-10, 1000 gram load, 1000 cycle, ASTM D4060	100 mg. Maximum weight loss
Adhesion	ASTM D .59 Initial 1000 hours	 5A 5A
Gloss	ASTM D 523 60° - 600 hours 60° - 1000 hours	 82% retention 90% retention (washed)
Hardness	ASTM D 3363	2H – No Gouge
Impact	ASTM D 2794 Direct	Pass 80 inch-lb.
Salt Spray Resistance	ASTM B 177 ASTM D 1654 1000 hours unscribed 400 hours scribed	 Table 2-10 Table 1-10
Weather Resistant	ASTM G 23, 1000 hours, 18 min. waterspray, 102 min. light	No film failure
Color	**Black**	
Identify	Infrared fingerprint	Match
Flexibility	180° bend; ½" dia, mandrel within 10 seconds	No breaks, flaking or cracks. Tested with a Q-panel with 2 mils or less of coating
Humidity	ASTM D 2247, 1000 hours	No blister or film failure
Thickness		4 mils +/- 1 mils

Mar Resistance		Good

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

Basis of Payment

The work under Items 824.401 and 824.402 will be paid for at the respective Contract lump sum prices, which prices shall include all labor, material, equipment and incidental costs required to complete the work.

Conduit will be paid for separately under Item 804.3, 3 Inch Electrical Conduit Type NM Plastic (UL).

ITEM 853.41	**TEMP. IMP. ATTENUATOR FOR SHLDR, INCAPABLE OF REDIRECTION**	**EACH**
ITEM 853.411	**TEMP. IMP. ATTENUATOR FOR SHLDR, INCAPABLE OF REDIRECTION R&R**	**EACH**

The work under these items shall conform to the relevant provisions of Sections of 850 of the Standard Specifications and the following:

The work under these items shall consist of installing, removing and resetting and maintaining temporary impact attenuators in locations as noted on the plans and as requested by the Engineer.

All temporary impact attenuator shall be designed for Test Level 2 (TL-2) on roadways having a posted speed less than or equal to 45 mph in accordance with the National Cooperative Highway Research Program Report (NCHRP) 350 and Manual for Assessing Safety Hardware (MASH).

All temporary impact attenuator shall be designed for Test Level 3 (TL-3) on roadways having a posted speed in excess of 45 mph in accordance with the National Cooperative Highway Research Program Report (NCHRP) 350 and Manual for Assessing Safety Hardware (MASH).

The Contractor shall submit manufacturers catalog cuts of the temporary impact attenuator to be used on the project in accordance with Section 8.02 of Standard Specifications for review and approval of the Engineer before commencement of the work.

All temporary impact attenuators shall be installed in accordance with the Manufacturer's requirements as detailed in the catalog cuts provided.

The Contractor shall repair or replace the temporary impact attenuator at no additional cost if it is damaged during the duration of construction.

Measurement and Payment

Payment under Item 853.41 shall be paid by the unit price per each, which shall include furnish and install, maintenance, and work incidental thereto.

Payment under Item 853.411 shall be paid by the unit price per each for existing temporary impact attenuator remove and reset to establish new work areas within the project limits. No payment will be made for daily removal and resetting of temporary impact attenuator for contractor access.

ITEM 874. **STREET NAME SIGN** **EACH**

The work under this item shall conform to the relevant provisions of Section 828 of the Standard Specifications, the City of Marlborough DPW Specifications and the following:

Sign Blade - All new street name signs blades shall be 9 inches high with varying lengths and shall be fabricated from extruded aluminum. In no event shall the length of the sign exceed 48 inches. In special cases of long street names, alternate abbreviations or exceptions to the font width factor may be granted by the City Director of Engineering. Corners shall have a radius of 1 inch, in all four corners.

Sheeting – All signs shall consist of two single sided high intensity blue Electrocut background with white Avery Prismatic letters. Edges of street signs shall be reinforced with 1 ¾" PVC spacers and riveted.

Lettering – The legend of (i.e. street name) shall be as shown on the plans or a directed by the Engineer. The color shall be white, displayed on both sides of the sign, all capitalized.

The letter size shall be 6 inch for the street name, all capitalized, and the name suffix shall be 3 inches high and abbreviated (ST, RD, AVE, etc.), all capitalized, centered vertically.

The font shall be Times New Roman with a width factor of between 0.5 and 0.7.

Mounting - All street name signs shall be sandwiched between a 10 - 12 foot length, 14 gauge, 1 ¾" aluminum square posts with a square rain cap and a 3'x 2"x 2", 12 gauge anchor. Orientation of signs shall be installed parallel, as possible, to corresponding streets. Street signs shall be riveted to aluminum post with 3/8" blue rivet. Signs must be erected with 7 feet of clearance (bottom of sign to sidewalk area).

- Approved vendors currently on file with the Marlborough D.P.W.:
  - Perma-Line Corporation
    P.O. Box 4515
    132 Court Street
    Brockton, MA 02303

    Phone: 508-588-6240
    FAX: 508-587-2110

  - Atlantic Highway Sign Co.
    Myles Standish Industrial Park
    John Quincy Adams Road
    Taunton, MA 02780

    Phone: 774-226-1300
    FAX: 617-361-2284

Or approved equal.

Measurement and Payment

Street name signs furnished and installed will be paid for at the contract unit price per each, which price shall include all labor, materials, equipment, and incidental cost required to complete the work. The unit price shall also include furnishing and installation of all hardware and brackets required to mount and install the street name signs as shown on the plans.

Street name sign supports will be paid for separately under Item 847.1, Sign Sup. (N/Guide)+Route Mkr w/1 Brkway Post Assembly - Steel.

ITEM 874.2 TRAFFIC SIGN REMOVED AND RESET EACH

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

The Contractor shall carefully remove and reset at new locations all existing signs, attachment hardware and sign support posts not included under other sign items as shown on the drawings and as directed by the Engineer.

Signs, attachment hardware and sign support posts shall be satisfactorily stored and protected until reset in the proposed work.

Signs, attachment hardware and sign support posts lost, damaged or otherwise made unsuitable for reuse while being removed, transported, stored or reset shall be replaced with new materials at no additional cost to the Owner. New attachment hardware shall be furnished and installed as necessary to replace any missing or unusable existing hardware.

Included under Item 874.2 are Warning-Regulatory, Street Name Signs and Route Marker signs, and miscellaneous directional signs.

Measurement

Traffic Sign Removed and Reset will be measured for payment as a unit, complete in place.

Basis of Payment

Traffic Sign Removed and Reset will be paid for at the respective Contract unit price per each, which prices shall include all labor, material, equipment and incidental costs required to complete the work.

ITEM 874.4 TRAFFIC SIGNS REMOVED AND STACKED EA

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

The work shall include the careful removal, transporting and stacking of signs, attached hardware and supports from locations shown on the plans and as directed by the Engineer.

The contractor shall accept and hold entirely responsibility for the removal, handling and stacking at a location convenient for removal by the Owner. Any signs and posts damaged or lost either directly or indirectly as a result of the Contractor's operations shall be replaced by the Contractor at no additional cost to the Owner. The Contractor shall coordinate the removal of signs and posts with the City of Marlborough by notifying them prior to and at the completion of the above work. Existing signs shall remain in place until proposed new signs are in place.

Traffic signs removed and stacked will be paid for at the Contract unit price for each, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 874.7 MISCELLANEOUS SIGNS REMOVED AND STACKED LUMP SUM

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

The work shall include the careful removal, transporting and stacking of the sign, attached hardware and support of the private sign located at the northwest corner of the Forest Street/Ames Street intersection.

The Contractor shall accept and hold entirely responsibility for the removal, handling and stacking at a location convenient for removal by the Owner. Any signs and posts damaged or lost either directly or indirectly as a result of the Contractor's operations shall be replaced by the Contractor at no additional cost to the Owner. The Contractor shall coordinate the removal of signs and posts with the City by notifying the City and the Engineer prior to and at the completion of the above work.

Basis of Payment

Miscellaneous signs removed and stacked will be paid for at the Contract lump sum price, which price shall include all labor, materials, equipment and incidental costs required to complete the work.

ITEM 983.3 RIP RAP REMOVED AND RELAID CUBIC YARD

Work under this item shall conform to the relevant provisions of Section 120 and 983 of the Standard Specifications and the following:

There is an existing riprap swale along both sides of the driveway located at approximately Station 23+75 LT. In order to meet the proposed grades, the riprap will need to be removed, the ground will then be re-graded and then the riprap shall be relaid.

The Contractor shall note the existing depth of stone and replace the stone to the same depth. The maximum slope of the relaid riprap shall be 2:1.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Rip Rap Removed and Relaid will be measure per cubic yard of rock relaid, complete in place and accepted by the Engineer.

Payment under this Item shall be made at the contract unit price per cubic yard, which price shall include full compensation for all labor, materials and equipment necessary to perform the work described above.

ITEM 999. CONSTRUCTION STAKING LUMP SUM

Under this item, the Contractor shall layout and set all lines, grades, and measurements necessary for construction of the work. The Engineer shall provide information on the baseline system and elevation control available.

All staking shall be directed and performed by qualified engineering or surveying personnel who are trained, experienced and skilled in construction layout of the type required under this Contract. The Contractor shall submit the qualifications of the survey personnel to the City of Marlborough for review and approval. The City reserves the right to reject any personnel which, in the City's judgment, are not adequately qualified. The City also reserves the right to evaluate the performance of the survey personnel during the course of the work and to require the replacement of any personnel whose work, in the judgment of the City, is unsatisfactory.

The Engineer may check the layout as established by the Contractor at any time as the work progresses. The Contractor shall be informed of the results of these checks, but the Engineer by doing so in no way relieves the Contractor of his responsibility for the accuracy of the layout work. The Contractor shall correct or replace any deficient layout and construction work which may be the result of inaccuracies in the Contractor's layout at no additional cost to the City.

Construction staking will be paid for at the Contract lump sum price for Item 999, which price shall include all labor, material, equipment and incidental costs required to complete the work.

Appendix A: EEO Processing Requirements

Equal Employment Opportunity is

THE LAW

Employers Holding Federal Contracts or Subcontracts

Applicants to and employees of companies with a Federal government contract or subcontract are protected under the following Federal authorities:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Executive Order 11246, as amended, prohibits job discrimination on the basis of race, color, religion, sex or national origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

INDIVIDUALS WITH DISABILITIES

Section 503 of the Rehabilitation Act of 1973, as amended, prohibits job discrimination because of disability and requires affirmative action to employ and advance in employment qualified individuals with disabilities who, with reasonable accommodation, can perform the essential functions of a job.

VIETNAM ERA, SPECIAL DISABLED, RECENTLY SEPARATED, AND OTHER PROTECTED VETERANS

38 U.S.C. 4212 of the Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, prohibits job discrimination and requires affirmative action to employ and advance in employment qualified Vietnam era veterans, qualified special disabled veterans, recently separarted veterans, and other protected veterans.

Any person who believes a contractor has violated its nondiscrimination or affirmative action obligations under the authorities above should contact immediately:

The Office of Federal Contract Compliance Programs (OFCCP), Employment Standards Administration, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210 or call (202) 693-0101, or an OFCCP regional or district office, listed in most telephone directories under U.S. Government, Department of Labor.

Private Employment, State and Local Governments, Educational Institutions

Applicants to and employees of most private employers, state and local governments, educational institutions, employment agencies and labor organizations are protected under the following Federal laws:

RACE, COLOR, RELIGION, SEX, NATIONAL ORIGIN

Title VII of the Civil Rights Act of 1964, as amended, prohibits discrimination in hiring, promotion, discharge, pay, fringe benefits, job training, classification, referral, and other aspects of employment, on the basis of race, color, religion, sex or national origin.

DISABILITY

The Americans with Disabilities Act of 1990, as amended, protects qualified applicants and employees with disabilities from discrimination in hiring, promotion, discharge, pay, job training, fringe benefits, classification, referral, and other aspects of employment on the basis of disability. The law also requires that covered entities provide qualified applicants and employees with disabilities with reasonable accommodations that do not impose undue hardship.

AGE

The Age Discrimination in Employment Act of 1967, as amended, protects applicants and employees 40 years of age or older from discrimination on the basis of age in hiring, promotion, discharge, compensation, terms, conditions or privileges of employment.

SEX (WAGES)

In addition to sex discrimination prohibited by Title VII of the Civil Rights Act of 1964, as amended (see above), the Equal Pay Act of 1963, as amended, prohibits sex discrimination in payment of wages to women and men performing substantially equal work in the same establishment.

Retaliation against a person who files a charge of discrimination, participates in an investigation, or opposes an unlawful employment practice is prohibited by all of these Federal laws.

If you believe that you have been discriminated against under any of the above laws, you should contact immediately:

The U.S. Equal Employment Opportunity Commission (EEOC), 1801 L Street, N.W., Washington, D.C. 20507 or an EEOC field office by calling toll free (800) 669-4000. For individuals with hearing impairments, EEOC's toll free TDD number is (800) 669-6820.

Programs or Activities Receiving Federal Financial Assistance

RACE, COLOR, RELIGION, NATIONAL ORIGIN, SEX

In addition to the protection of Title VII of the Civil Rights Act of 1964, as amended, Title VI of the Civil Rights Act prohibits discrimination on the basis of race, color or national origin in programs or activities receiving Federal financial assistance. Employment discrimination is covered by Title VI if the primary objective of the financial assistance is provision of employment, or where employment discrimination causes or may cause discrimination in providing services under such programs. Title IX of the Education Amendments of 1972 prohibits employment discrimination on the basis of sex in educational programs or activities which receive Federal assistance.

INDIVIDUALS WITH DISABILITIES

Sections 501, 504 and 505 of the Rehabilitation Act of 1973, as amended, prohibits employment discrimination on the basis of disability in any program or activity which receives Federal financial assistance in the federal government. Discrimination is prohibited in all aspects of employment against persons with disabilities who, with reasonable accommodation, can perform the essential functions of a job.

If you believe you have been discriminated against in a program of any institution which receives Federal assistance, you should contact immediately the Federal agency providing such assistance.

La Igualdad De Oportunidades De Empleo Es

LA LEY

Empleadores con Contratos o Subcontratos Federales

Solicitantes de empleo y empleados de compañías privadas que tienen un contrato o subcontrato federal son protegidos por las siguientes autoridades federales:

RAZA, COLOR, RELIGION, SEXO, ORIGEN NACIONAL

La Orden del Poder Ejecutivo 11246, según enmendada, prohibe la discriminación en el empleo por razón de raza, color, religión, sexo u origen nacional, y requiere programas de acción afirmativa para asegurar la igualdad de oportunidades en todos los aspectos de empleo.

INDIVIDUOS CON IMPEDIMENTOS

La Sección 503 de la Ley de Rehabilitación cle 1973, según enmendada, prohibe la discriminación en el empleo por razón de impedimento y requiere programas de acción afirmativa en la contratación y ascenso de personas calificadas con impedimentos que, con comodidad razonable, pueden desempeñar las funciones esenciales del empleo.

VETERANOS DE LA ERA DE VIETNAM ,VETERANOS CON IMPEDIMENTOS ESPECIALES, Y OTROS VETERANOS PROTEGIDOS

38 U.S.C. 4212 de la Ley de Asistencia para la Readaptación de los Veteranos de Vietnam prohibe la discriminación en el empleo y exige programas de acción afirmativa en la contratación y ascenso de veteranos calificados de Vietnam y de veteranos calificados con impedimentos especiales.

Cualquier persona que crea que un contratista no ha cumplido con sus obligaciones referentes a la no discriminación o los programas de acción afirmativa bajo las leyes anteriormente mencionadas debe comunicarse de inmediato con:

The Office of Federal Contract Compliance Programs (OFCCP), Employment Standards Administration, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 202 10 o llamar al(202)693-0101, 0 una oficina regional o de distrito del OFCCR listado bajo el titulo U.S. Government, Department of Labor.

Empleadores Privados, Gobiernos Estatales y Locales, Instituciones de Enseñanza

Las siguientes leyes federales protegen solicitantes de empleo y empleados de la mayoria de los empleadores privados, gobier -nos estatales y locales, instituciones de enseñanza, agencias de empleo y organizaciones laborales:

RAZA, COLOR, RELIGION, SEXO, ORIGEN NACIONAL

El Titulo V11 de la Ley de Derechos Civiles de 1964, según enmendada, prohibe la discriminación en el empleo por razón de raza, color, religión, sexo u origen nacional en la contratación, promoción, despido, pago, beneficios suplementarios, programas de adiestramiento, clasificación de empleo, reclutarniento y bajo cualquier otro término y condición de empleo.

IMPEDIMENTO

La Ley para Personas con Impedimentos de 1990, según enmendada, protege solicitantes de empleados y emptea dos con impedimentos contra la discriminación en la contratación, promoción, despido, pago, programas de adiestramiento, beneficios suplementarios, clasificación, asignación, y otros aspectos de empleo por razón de impedimento. La ley también exige que toda entidad comprendida proporcione a solicitantes de empleo y empleados calificados con impedimentos comodidad razonable al menos que esto cause dificultad excesiva.

EDAD

La Ley Contra la Discriminación en el Empleo por Razón de Edad de 1967, según enmendada, protege solicitantes de empleo y empleados de 40 años de edad o más de la discriminación en el empleo por razón de edad en la contratación, promoción, despido, pago, y bajo cualquier otro término, condición o privilegio de empleo.

SEXO (PAGO)

Ademas del Titulo V11 de la Ley de Derechos Civiles de 1964 (anteriormente descrita), la Ley de Igualdad en el Pago de 1963, según enmendada, prohibe la discriminación por razón de sexo en el pago de salario a mujeres y hombres que realizan trabajos sustancialmente iguales en el mismo lugar de trabajo.

Tomar represalia contra una persona que haya presentado una denuncia de discriminación, participe en una investigación, o se oponga a una práctica ilegal de empleo es prohibido por todas estas leyes federales.

Si usted cree que ha sido discriminado bajo cualquiera de las leyes descritas, debe comunicarse de inmediato con:

La Comisión de Igualclad cle Oportuniclades de Empleo (EEOC), 1801 L Street, N.W., Washington, D.C. 20507 o con una oficina local de la Comisión Harnando gratuitamente al (800) 669-4000. Para personas con impedimentos auditivos, el número sin cargo de la Comisión por el sisterna TDD es (800) 669-6820.

Programas o Actividades que Reciben Subsidios Federales

RAZA, COLOR, ORIGEN NACIONAL, SEXO

Además del amparo que brinda el Titulo VII cle la Ley de Derechos Civiles de 1964, el Titulo VI de la ley prohibe la discriminación por razón de raza, color, u origen nacional en programas o actividades que reciben subsidios federales. Discriminación en el empleo está comprendida bajo el Titulo VI si el objetivo primordial del subsidio es proporcionar empleos y en los casos en que la discriminación en el empleo causa o podría causar discriminación en la prestación de servicios de esos programas. El Titulo IX de las Enmiendas de Educación de 1972 prohibe la discriminación en el empleo por razón de sexo en programas o actividades educacionales que reciben subsidios federales.

INDIVIDUOS CON IMPEDIMENTOS

La Sección 504 de la Ley de Rehabilitación de 1973, según enmendada, prohibe la discriminación en el empleo por razón de impedimentos en cualquier programa o actividad que recibe subsidios del gobierno federal. Se prohibe la discriminación en todas las modalidades de empleo contra personas con impedimentos fisicos y mentales que, con comodidad razonable, pueden desempeñar las funciones esenciales del empleo.

Si usted cree que ha sido discriminado en el empleo en un programa de cualquier institución que recibe subsidios federales, debe comunicarse de inmediato con la agencia federal que otorga el subsidio.

Appendix B: State Prevailing Wage Rates And Forms

DEVAL L. PATRICK
Governor

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

RACHEL KAPRIELIAN
Secretary

HEATHER E. ROWE
Director

Awarding Authority: City of Marlborough

Contract Number:

City/Town: MARLBOROUGH

Description of Work: Simarano Drive - Full depth road reconstruction and realignment, pavement milling and overlay, traffic signal improvements, construction of new sidewalk, drainage improvements.

Job Location: Simarano Drive

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- Awarding authorities must request an updated wage schedule from the Department of Labor Standards ("DLS") if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. Once a contractor has been selected by the awarding authority, the wage schedule shall be made a part of the contract for that project. The wage schedule must be posted in a conspicuous place at the work site during the life of the project in accordance with M.G.L. c. 149, § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project regardless of whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- All apprentices working on the project are required to be registered with the Massachusetts Division of Apprentice Training (DAT). Apprentices must keep his/her apprentice identification card on his/her person during all work hours on the project. If an apprentice rate is listed on the prevailing wage schedule for the trade in which an apprentice is registered with the DAT, the apprentice may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **If an apprentice rate is not listed on the prevailing wage schedule for the trade in which an apprentice is registered with the DAT, the apprentice must be paid the journeyworker's rate for the trade.**
- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule. Awarding authorities are required to request these updates no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. Contractors are required to obtain the wage schedules from awarding authorities, and to pay no less than these rates to covered workers. The annual update requirement is not applicable to 27F "rental of equipment" contracts.
- Every contractor or subcontractor which performs construction work on the project is required to submit weekly payroll reports directly to the awarding authority and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. A sample of a payroll reporting form may be obtained at http://www.mass.gov/dols/pw.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may report the violation to the Fair Labor Division of the office of the Attorney General at (617) 727-3465.
- Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2013	$30.95	$9.41	$8.80	$0.00	$49.16
	06/01/2014	$31.30	$9.41	$8.80	$0.00	$49.51
	08/01/2014	$31.30	$9.91	$8.80	$0.00	$50.01
	12/01/2014	$31.30	$9.91	$9.33	$0.00	$50.54
	06/01/2015	$31.65	$9.91	$9.33	$0.00	$50.89
	08/01/2015	$31.65	$10.41	$9.33	$0.00	$51.39
	12/01/2015	$31.65	$10.41	$10.08	$0.00	$52.14
	06/01/2016	$32.15	$10.41	$10.08	$0.00	$52.64
	08/01/2016	$32.15	$10.91	$10.08	$0.00	$53.14
	12/01/2016	$32.15	$10.91	$10.89	$0.00	$53.95
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2013	$31.02	$9.41	$8.80	$0.00	$49.23
	06/01/2014	$31.37	$9.41	$8.80	$0.00	$49.58
	08/01/2014	$31.37	$9.91	$8.80	$0.00	$50.08
	12/01/2014	$31.37	$9.91	$9.33	$0.00	$50.61
	06/01/2015	$31.72	$9.91	$9.33	$0.00	$50.96
	08/01/2015	$31.72	$10.41	$9.33	$0.00	$51.46
	12/01/2015	$31.72	$10.41	$10.08	$0.00	$52.21
	06/01/2016	$32.22	$10.41	$10.08	$0.00	$52.71
	08/01/2016	$32.22	$10.91	$10.08	$0.00	$53.21
	12/01/2016	$32.22	$10.91	$10.89	$0.00	$54.02
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2013	$31.14	$9.41	$8.80	$0.00	$49.35
	06/01/2014	$31.49	$9.41	$8.80	$0.00	$49.70
	08/01/2014	$31.49	$9.91	$8.80	$0.00	$50.20
	12/01/2014	$31.49	$9.91	$9.33	$0.00	$50.73
	06/01/2015	$31.84	$9.91	$9.33	$0.00	$51.08
	08/01/2015	$31.84	$10.41	$9.33	$0.00	$51.58
	12/01/2015	$31.84	$10.41	$10.08	$0.00	$52.33
	06/01/2016	$32.34	$10.41	$10.08	$0.00	$52.83
	08/01/2016	$32.34	$10.91	$10.08	$0.00	$53.33
	12/01/2016	$32.34	$10.91	$10.89	$0.00	$54.14
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2013	$84.21	$9.80	$18.17	$0.00	$112.18
	08/01/2014	$87.36	$9.80	$18.17	$0.00	$115.33
	08/01/2015	$90.51	$9.80	$18.17	$0.00	$118.48
AIR TRACK OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.60	$7.30	$12.10	$0.00	$50.00
	06/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	12/01/2014	$31.60	$7.30	$12.10	$0.00	$51.00
	06/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	12/01/2015	$32.60	$7.30	$12.10	$0.00	$52.00
	06/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
	12/01/2016	$33.85	$7.30	$12.10	$0.00	$53.25

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2013	$30.68	$10.40	$5.95	$0.00	$47.03
	06/01/2014	$31.58	$10.40	$5.95	$0.00	$47.93
	12/01/2014	$32.48	$10.40	$5.95	$0.00	$48.83
	06/01/2015	$33.43	$10.40	$5.95	$0.00	$49.78
	12/01/2015	$34.38	$10.40	$5.95	$0.00	$50.73
ASPHALT RAKER *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.49	$10.00	$14.18	$0.00	$64.67
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.49	$10.00	$14.18	$0.00	$64.67
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 2*	12/01/2013	$30.60	$7.30	$12.10	$0.00	$50.00
	06/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	12/01/2014	$31.60	$7.30	$12.10	$0.00	$51.00
	06/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	12/01/2015	$32.60	$7.30	$12.10	$0.00	$52.00
	06/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
	12/01/2016	$33.85	$7.30	$12.10	$0.00	$53.25
For apprentice rates see "Apprentice- LABORER"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2010	$37.70	$6.97	$11.18	$0.00	$55.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2010

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$24.51	$6.97	$11.18	$0.00	$42.66
2	65	$24.51	$6.97	$11.18	$0.00	$42.66
3	70	$26.39	$6.97	$11.18	$0.00	$44.54
4	75	$28.28	$6.97	$11.18	$0.00	$46.43
5	80	$30.16	$6.97	$11.18	$0.00	$48.31
6	85	$32.05	$6.97	$11.18	$0.00	$50.20
7	90	$33.93	$6.97	$11.18	$0.00	$52.08
8	95	$35.82	$6.97	$11.18	$0.00	$53.97

Notes:

Apprentice to Journeyworker Ratio:1:5

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (LOWELL)*	03/01/2014	$45.96	$10.18	$17.55	$0.00	$73.69
	09/01/2014	$46.86	$10.18	$17.62	$0.00	$74.66
	03/01/2015	$47.42	$10.18	$17.62	$0.00	$75.22
	09/01/2015	$48.32	$10.18	$17.69	$0.00	$76.19
	03/01/2016	$48.89	$10.18	$17.69	$0.00	$76.76
	09/01/2016	$49.79	$10.18	$17.77	$0.00	$77.74
	03/01/2017	$50.36	$10.18	$17.77	$0.00	$78.31

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Lowell*

Effective Date - 03/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.98	$10.18	$17.55	$0.00	$50.71
2	60	$27.58	$10.18	$17.55	$0.00	$55.31
3	70	$32.17	$10.18	$17.55	$0.00	$59.90
4	80	$36.77	$10.18	$17.55	$0.00	$64.50
5	90	$41.36	$10.18	$17.55	$0.00	$69.09

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.43	$10.18	$17.62	$0.00	$51.23
2	60	$28.12	$10.18	$17.62	$0.00	$55.92
3	70	$32.80	$10.18	$17.62	$0.00	$60.60
4	80	$37.49	$10.18	$17.62	$0.00	$65.29
5	90	$42.17	$10.18	$17.62	$0.00	$69.97

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2013	$34.45	$7.30	$12.90	$0.00	$54.65
	06/01/2014	$35.20	$7.30	$12.90	$0.00	$55.40
	12/01/2014	$35.95	$7.30	$12.90	$0.00	$56.15
	06/01/2015	$36.70	$7.30	$12.90	$0.00	$56.90
	12/01/2015	$37.45	$7.30	$12.90	$0.00	$57.65
	06/01/2016	$38.20	$7.30	$12.90	$0.00	$58.40
	12/01/2016	$39.20	$7.30	$12.90	$0.00	$59.40
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2013	$33.30	$7.30	$12.90	$0.00	$53.50
	06/01/2014	$34.05	$7.30	$12.90	$0.00	$54.25
	12/01/2014	$34.80	$7.30	$12.90	$0.00	$55.00
	06/01/2015	$35.55	$7.30	$12.90	$0.00	$55.75
	12/01/2015	$36.30	$7.30	$12.90	$0.00	$56.50
	06/01/2016	$37.05	$7.30	$12.90	$0.00	$57.25
	12/01/2016	$38.05	$7.30	$12.90	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2013	$33.30	$7.30	$12.90	$0.00	$53.50
	06/01/2014	$34.05	$7.30	$12.90	$0.00	$54.25
	12/01/2014	$34.80	$7.30	$12.90	$0.00	$55.00
	06/01/2015	$35.55	$7.30	$12.90	$0.00	$55.75
	12/01/2015	$36.30	$7.30	$12.90	$0.00	$56.50
	06/01/2016	$37.05	$7.30	$12.90	$0.00	$57.25
	12/01/2016	$38.05	$7.30	$12.90	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	03/01/2014	$34.78	$9.80	$15.91	$0.00	$60.49
	09/01/2014	$35.55	$9.80	$15.91	$0.00	$61.26
	03/01/2015	$36.32	$9.80	$15.91	$0.00	$62.03

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 03/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.39	$9.80	$1.57	$0.00	$28.76
2	60	$20.87	$9.80	$1.57	$0.00	$32.24
3	70	$24.35	$9.80	$11.20	$0.00	$45.35
4	75	$26.09	$9.80	$11.20	$0.00	$47.09
5	80	$27.82	$9.80	$12.77	$0.00	$50.39
6	80	$27.82	$9.80	$12.77	$0.00	$50.39
7	90	$31.30	$9.80	$14.34	$0.00	$55.44
8	90	$31.30	$9.80	$14.34	$0.00	$55.44

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.78	$9.80	$1.57	$0.00	$29.15
2	60	$21.33	$9.80	$1.57	$0.00	$32.70
3	70	$24.89	$9.80	$11.20	$0.00	$45.89
4	75	$26.66	$9.80	$11.20	$0.00	$47.66
5	80	$28.44	$9.80	$12.77	$0.00	$51.01
6	80	$28.44	$9.80	$12.77	$0.00	$51.01
7	90	$32.00	$9.80	$14.34	$0.00	$56.14
8	90	$32.00	$9.80	$14.34	$0.00	$56.14

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (LOWELL)*	01/01/2014	$39.29	$10.90	$18.71	$1.30	$70.20
	07/01/2014	$40.12	$10.90	$18.71	$1.30	$71.03
	01/01/2015	$40.80	$10.90	$18.71	$1.30	$71.71
	07/01/2015	$41.63	$10.90	$18.71	$1.30	$72.54
	01/01/2016	$42.32	$10.90	$18.71	$1.30	$73.23

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CEMENT MASONRY/PLASTERING - Lowell*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.65	$10.90	$12.21	$1.30	$44.06
2	60	$23.57	$10.90	$13.71	$1.30	$49.48
3	65	$25.54	$10.90	$14.71	$1.30	$52.45
4	70	$27.50	$10.90	$15.71	$1.30	$55.41
5	75	$29.47	$10.90	$16.71	$1.30	$58.38
6	80	$31.43	$10.90	$17.71	$1.30	$61.34
7	90	$35.36	$10.90	$18.71	$1.30	$66.27

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.06	$10.90	$12.21	$1.30	$44.47
2	60	$24.07	$10.90	$13.71	$1.30	$49.98
3	65	$26.08	$10.90	$14.71	$1.30	$52.99
4	70	$28.08	$10.90	$15.71	$1.30	$55.99
5	75	$30.09	$10.90	$16.71	$1.30	$59.00
6	80	$32.10	$10.90	$17.71	$1.30	$62.01
7	90	$36.11	$10.90	$18.71	$1.30	$67.02

Notes:

Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$41.49	$10.00	$14.18	$0.00	$65.67
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$28.11	$10.00	$14.18	$0.00	$52.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2014	$45.91	$7.85	$16.10	$0.00	$69.86
	07/01/2014	$46.76	$7.85	$16.10	$0.00	$70.71
	01/01/2015	$47.66	$7.85	$16.10	$0.00	$71.61
	07/01/2015	$48.56	$7.85	$16.10	$0.00	$72.51
	01/01/2016	$49.51	$7.85	$16.10	$0.00	$73.46
	07/01/2016	$50.46	$7.85	$16.10	$0.00	$74.41
	01/01/2017	$51.41	$7.85	$16.10	$0.00	$75.36

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.96	$7.85	$0.00	$0.00	$30.81
2	55	$25.25	$7.85	$3.66	$0.00	$36.76
3	60	$27.55	$7.85	$3.99	$0.00	$39.39
4	65	$29.84	$7.85	$4.32	$0.00	$42.01
5	70	$32.14	$7.85	$14.11	$0.00	$54.10
6	75	$34.43	$7.85	$14.44	$0.00	$56.72
7	80	$36.73	$7.85	$14.77	$0.00	$59.35
8	90	$41.32	$7.85	$15.44	$0.00	$64.61

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.38	$7.85	$0.00	$0.00	$31.23
2	55	$25.72	$7.85	$3.66	$0.00	$37.23
3	60	$28.06	$7.85	$3.99	$0.00	$39.90
4	65	$30.39	$7.85	$4.32	$0.00	$42.56
5	70	$32.73	$7.85	$14.11	$0.00	$54.69
6	75	$35.07	$7.85	$14.44	$0.00	$57.36
7	80	$37.41	$7.85	$14.77	$0.00	$60.03
8	90	$42.08	$7.85	$15.44	$0.00	$65.37

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 2*	12/01/2013	$33.50	$7.30	$12.70	$0.00	$53.50
	06/01/2014	$34.25	$7.30	$12.70	$0.00	$54.25
	12/01/2014	$35.00	$7.30	$12.70	$0.00	$55.00
	06/01/2015	$35.75	$7.30	$12.70	$0.00	$55.75
	12/01/2015	$36.50	$7.30	$12.70	$0.00	$56.50
For apprentice rates see "Apprentice- LABORER"						
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2013	$34.50	$7.30	$12.70	$0.00	$54.50
	06/01/2014	$35.25	$7.30	$12.70	$0.00	$55.25
	12/01/2014	$36.00	$7.30	$12.70	$0.00	$56.00
	06/01/2015	$36.75	$7.30	$12.70	$0.00	$56.75
	12/01/2015	$37.50	$7.30	$12.70	$0.00	$57.50
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 2*	12/01/2013	$34.25	$7.30	$12.70	$0.00	$54.25
	06/01/2014	$35.00	$7.30	$12.70	$0.00	$55.00
	12/01/2014	$35.75	$7.30	$12.70	$0.00	$55.75
	06/01/2015	$36.50	$7.30	$12.70	$0.00	$56.50
	12/01/2015	$37.25	$7.30	$12.70	$0.00	$57.25
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 2*	12/01/2013	$34.50	$7.30	$12.70	$0.00	$54.50
	06/01/2014	$35.25	$7.30	$12.70	$0.00	$55.25
	12/01/2014	$36.00	$7.30	$12.70	$0.00	$56.00
	06/01/2015	$36.75	$7.30	$12.70	$0.00	$56.75
	12/01/2015	$37.50	$7.30	$12.70	$0.00	$57.50
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2013	$34.25	$7.30	$12.70	$0.00	$54.25
	06/01/2014	$35.00	$7.30	$12.70	$0.00	$55.00
	12/01/2014	$35.75	$7.30	$12.70	$0.00	$55.75
	06/01/2015	$36.50	$7.30	$12.70	$0.00	$56.50
	12/01/2015	$37.25	$7.30	$12.70	$0.00	$57.25
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 2*	12/01/2013	$33.50	$7.30	$12.70	$0.00	$53.50
	06/01/2014	$34.25	$7.30	$12.70	$0.00	$54.25
	12/01/2014	$35.00	$7.30	$12.70	$0.00	$55.00
	06/01/2015	$35.75	$7.30	$12.70	$0.00	$55.75
	12/01/2015	$36.50	$7.30	$12.70	$0.00	$56.50
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2013	$56.14	$9.80	$18.17	$0.00	$84.11
	08/01/2014	$58.24	$9.80	$18.17	$0.00	$86.21
	08/01/2015	$60.34	$9.80	$18.17	$0.00	$88.31
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2013	$40.10	$9.80	$18.17	$0.00	$68.07
	08/01/2014	$41.60	$9.80	$18.17	$0.00	$69.57
	08/01/2015	$43.10	$9.80	$18.17	$0.00	$71.07
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2013	$60.15	$9.80	$18.17	$0.00	$88.12
	08/01/2014	$62.40	$9.80	$18.17	$0.00	$90.37
	08/01/2015	$64.65	$9.80	$18.17	$0.00	$92.62
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2013	$84.21	$9.80	$18.17	$0.00	$112.18
	08/01/2014	$87.36	$9.80	$18.17	$0.00	$115.33
	08/01/2015	$90.51	$9.80	$18.17	$0.00	$118.48
ELECTRICIAN *ELECTRICIANS LOCAL 96*	12/01/2013	$37.87	$7.66	$12.69	$0.00	$58.22
	06/01/2014	$38.12	$7.91	$12.86	$0.00	$58.89
	12/01/2014	$38.37	$8.16	$13.12	$0.00	$59.65
	06/01/2015	$38.87	$8.16	$13.62	$0.00	$60.65
	12/01/2015	$39.37	$8.41	$13.68	$0.00	$61.46

Apprentice - *ELECTRICIAN - Local 96*

Effective Date - 12/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$15.15	$7.66	$0.45	$0.00	$23.26
2	43	$16.28	$7.66	$0.49	$0.00	$24.43
3	48	$18.18	$7.66	$9.93	$0.00	$35.77
4	55	$20.83	$7.66	$10.29	$0.00	$38.78
5	65	$24.62	$7.66	$10.83	$0.00	$43.11
6	80	$30.30	$7.66	$11.63	$0.00	$49.59

Effective Date - 06/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$15.25	$7.91	$0.46	$0.00	$23.62
2	43	$16.39	$7.91	$0.49	$0.00	$24.79
3	48	$18.30	$7.91	$10.09	$0.00	$36.30
4	55	$20.97	$7.91	$10.47	$0.00	$39.35
5	65	$24.78	$7.91	$11.00	$0.00	$43.69
6	80	$30.50	$7.91	$11.81	$0.00	$50.22

Notes:
Steps 1-2 are 1000 hrs; Steps 3-6 are 1500 hrs.

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR
ELEVATOR CONSTRUCTORS LOCAL 4
01/01/2012 | $52.45 | $8.78 | $6.96 | $0.00 | $68.19

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*

Effective Date - 01/01/2012

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.23	$8.78	$0.00	$0.00	$35.01
2	55	$28.85	$8.78	$6.96	$0.00	$44.59
3	65	$34.09	$8.78	$6.96	$0.00	$49.83
4	70	$36.72	$8.78	$6.96	$0.00	$52.46
5	80	$41.96	$8.78	$6.96	$0.00	$57.70

Notes:
Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER
ELEVATOR CONSTRUCTORS LOCAL 4
01/01/2012 | $38.59 | $8.78 | $6.96 | $0.00 | $54.33

For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2014	$38.87	$10.00	$14.18	$0.00	$63.05
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2014	$40.29	$10.00	$14.18	$0.00	$64.47
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2014	$20.92	$10.00	$14.18	$0.00	$45.10
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 96*	12/01/2013	$37.87	$7.66	$12.69	$0.00	$58.22
	06/01/2014	$38.12	$7.91	$12.86	$0.00	$58.89
	12/01/2014	$38.37	$8.16	$13.12	$0.00	$59.65
	06/01/2015	$38.87	$8.16	$13.62	$0.00	$60.65
	12/01/2015	$39.37	$8.41	$13.68	$0.00	$61.46
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINT/COMMISSIONING *ELECTRICIANS LOCAL 96*	12/01/2013	$37.87	$7.66	$12.69	$0.00	$58.22
	06/01/2014	$38.12	$7.91	$12.86	$0.00	$58.89
	12/01/2014	$38.37	$8.16	$13.12	$0.00	$59.65
	06/01/2015	$38.87	$8.16	$13.62	$0.00	$60.65
	12/01/2015	$39.37	$8.41	$13.68	$0.00	$61.46
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$33.76	$10.00	$14.18	$0.00	$57.94
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 2*	12/01/2013	$20.50	$7.30	$12.10	$0.00	$39.90
	06/01/2014	$20.50	$7.30	$12.10	$0.00	$39.90
	12/01/2014	$20.50	$7.30	$12.10	$0.00	$39.90
	06/01/2015	$20.50	$7.30	$12.10	$0.00	$39.90
	12/01/2015	$20.50	$7.30	$12.10	$0.00	$39.90
	06/01/2016	$20.50	$7.30	$12.10	$0.00	$39.90
	12/01/2016	$20.50	$7.30	$12.10	$0.00	$39.90
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE 1*	03/01/2014	$39.87	$9.80	$16.96	$0.00	$66.63

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *FLOORCOVERER - Local 2168 Zone I*

Effective Date - 03/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.94	$9.80	$1.79	$0.00	$31.53
2	55	$21.93	$9.80	$1.79	$0.00	$33.52
3	60	$23.92	$9.80	$11.59	$0.00	$45.31
4	65	$25.92	$9.80	$11.59	$0.00	$47.31
5	70	$27.91	$9.80	$13.38	$0.00	$51.09
6	75	$29.90	$9.80	$13.38	$0.00	$53.08
7	80	$31.90	$9.80	$15.17	$0.00	$56.87
8	85	$33.89	$9.80	$15.17	$0.00	$58.86

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.49	$10.00	$14.18	$0.00	$64.67
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$28.11	$10.00	$14.18	$0.00	$52.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	01/01/2014	$35.41	$7.85	$16.10	$0.00	$59.36
	07/01/2014	$36.26	$7.85	$16.10	$0.00	$60.21
	01/01/2015	$37.16	$7.85	$16.10	$0.00	$61.11
	07/01/2015	$38.06	$7.85	$16.10	$0.00	$62.01
	01/01/2016	$39.01	$7.85	$16.10	$0.00	$62.96
	07/01/2016	$39.96	$7.85	$16.10	$0.00	$63.91
	01/01/2017	$40.91	$7.85	$16.10	$0.00	$64.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 35 Zone 2*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.71	$7.85	$0.00	$0.00	$25.56
2	55	$19.48	$7.85	$3.66	$0.00	$30.99
3	60	$21.25	$7.85	$3.99	$0.00	$33.09
4	65	$23.02	$7.85	$4.32	$0.00	$35.19
5	70	$24.79	$7.85	$14.11	$0.00	$46.75
6	75	$26.56	$7.85	$14.44	$0.00	$48.85
7	80	$28.33	$7.85	$14.77	$0.00	$50.95
8	90	$31.87	$7.85	$15.44	$0.00	$55.16

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.13	$7.85	$0.00	$0.00	$25.98
2	55	$19.94	$7.85	$3.66	$0.00	$31.45
3	60	$21.76	$7.85	$3.99	$0.00	$33.60
4	65	$23.57	$7.85	$4.32	$0.00	$35.74
5	70	$25.38	$7.85	$14.11	$0.00	$47.34
6	75	$27.20	$7.85	$14.44	$0.00	$49.49
7	80	$29.01	$7.85	$14.77	$0.00	$51.63
8	90	$32.63	$7.85	$15.44	$0.00	$55.92

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.49	$10.00	$14.18	$0.00	$64.67

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$22.27	$10.00	$0.00	$0.00	$32.27
2	60	$24.29	$10.00	$14.18	$0.00	$48.47
3	65	$26.32	$10.00	$14.18	$0.00	$50.50
4	70	$28.34	$10.00	$14.18	$0.00	$52.52
5	75	$30.37	$10.00	$14.18	$0.00	$54.55
6	80	$32.39	$10.00	$14.18	$0.00	$56.57
7	85	$34.42	$10.00	$14.18	$0.00	$58.60
8	90	$36.44	$10.00	$14.18	$0.00	$60.62

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2014	$42.76	$9.82	$19.74	$2.17	$74.49
	08/01/2014	$43.61	$9.82	$19.74	$2.17	$75.34
	02/01/2015	$44.51	$9.82	$19.74	$2.17	$76.24
	08/01/2015	$45.51	$9.82	$19.74	$2.17	$77.24
	02/01/2016	$46.51	$9.82	$19.74	$2.17	$78.24
	08/01/2016	$47.66	$9.82	$19.74	$2.17	$79.39
	02/01/2017	$48.76	$9.82	$19.74	$2.17	$80.49
	08/01/2017	$49.86	$9.82	$19.74	$2.17	$81.59
	02/01/2018	$51.01	$9.82	$19.74	$2.17	$82.74
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 96*	12/01/2013	$37.87	$7.66	$12.69	$0.00	$58.22
	06/01/2014	$38.12	$7.91	$12.86	$0.00	$58.89
	12/01/2014	$38.37	$8.16	$13.12	$0.00	$59.65
	06/01/2015	$38.87	$8.16	$13.62	$0.00	$60.65
	12/01/2015	$39.37	$8.41	$13.68	$0.00	$61.46
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2014	$42.76	$9.82	$19.74	$2.17	$74.49
	08/01/2014	$43.61	$9.82	$19.74	$2.17	$75.34
	02/01/2015	$44.51	$9.82	$19.74	$2.17	$76.24
	08/01/2015	$45.51	$9.82	$19.74	$2.17	$77.24
	02/01/2016	$46.51	$9.82	$19.74	$2.17	$78.24
	08/01/2016	$47.66	$9.82	$19.74	$2.17	$79.39
	02/01/2017	$48.76	$9.82	$19.74	$2.17	$80.49
	08/01/2017	$49.86	$9.82	$19.74	$2.17	$81.59
	02/01/2018	$51.01	$9.82	$19.74	$2.17	$82.74
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PIPEFITTERS LOCAL 537*	03/01/2013	$49.34	$8.75	$14.39	$0.00	$72.48
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC MECHANIC *PIPEFITTERS LOCAL 537*	03/01/2013	$49.34	$8.75	$14.39	$0.00	$72.48
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS *LABORERS - ZONE 2*	12/01/2013	$30.60	$7.30	$12.10	$0.00	$50.00
	06/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	12/01/2014	$31.60	$7.30	$12.10	$0.00	$51.00
	06/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	12/01/2015	$32.60	$7.30	$12.10	$0.00	$52.00
	06/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
	12/01/2016	$33.85	$7.30	$12.10	$0.00	$53.25
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2013	$42.11	$10.95	$12.10	$0.00	$65.16
	09/01/2014	$44.11	$10.95	$12.10	$0.00	$67.16

Apprentice - *ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston*

Effective Date - 09/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.06	$10.95	$9.00	$0.00	$41.01
2	60	$25.27	$10.95	$9.62	$0.00	$45.84
3	70	$29.48	$10.95	$10.24	$0.00	$50.67
4	80	$33.69	$10.95	$10.86	$0.00	$55.50

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.06	$10.95	$9.00	$0.00	$42.01
2	60	$26.47	$10.95	$9.62	$0.00	$47.04
3	70	$30.88	$10.95	$10.24	$0.00	$52.07
4	80	$35.29	$10.95	$10.86	$0.00	$57.10

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (WORCESTER AREA)*	03/16/2014	$40.89	$7.70	$19.25	$0.00	$67.84

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Worcester*

Effective Date - 03/16/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$24.53	$7.70	$19.25	$0.00	$51.48
2	70	$28.62	$7.70	$19.25	$0.00	$55.57
3	75	$30.67	$7.70	$19.25	$0.00	$57.62
4	80	$32.71	$7.70	$19.25	$0.00	$59.66
5	85	$34.76	$7.70	$19.25	$0.00	$61.71
6	90	$36.80	$7.70	$19.25	$0.00	$63.75

Notes:
Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 2*	12/01/2013	$29.85	$7.30	$12.10	$0.00	$49.25
	06/01/2014	$30.35	$7.30	$12.10	$0.00	$49.75
	12/01/2014	$30.85	$7.30	$12.10	$0.00	$50.25
	06/01/2015	$31.35	$7.30	$12.10	$0.00	$50.75
	12/01/2015	$31.85	$7.30	$12.10	$0.00	$51.25
	06/01/2016	$32.35	$7.30	$12.10	$0.00	$51.75
	12/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER - Zone 2*

Effective Date - 12/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$17.91	$7.30	$12.10	$0.00	$37.31
2	70	$20.90	$7.30	$12.10	$0.00	$40.30
3	80	$23.88	$7.30	$12.10	$0.00	$43.28
4	90	$26.87	$7.30	$12.10	$0.00	$46.27

Effective Date - 06/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$18.21	$7.30	$12.10	$0.00	$37.61
2	70	$21.25	$7.30	$12.10	$0.00	$40.65
3	80	$24.28	$7.30	$12.10	$0.00	$43.68
4	90	$27.32	$7.30	$12.10	$0.00	$46.72

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 2*	12/01/2013	$29.85	$7.30	$12.10	$0.00	$49.25
	06/01/2014	$30.35	$7.30	$12.10	$0.00	$49.75
	12/01/2014	$30.85	$7.30	$12.10	$0.00	$50.25
	06/01/2015	$31.35	$7.30	$12.10	$0.00	$50.75
	12/01/2015	$31.85	$7.30	$12.10	$0.00	$51.25
	06/01/2016	$32.35	$7.30	$12.10	$0.00	$51.75
	12/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 2*	12/01/2013	$29.85	$7.30	$12.10	$0.00	$49.25
	06/01/2014	$30.35	$7.30	$12.10	$0.00	$49.75
	12/01/2014	$30.85	$7.30	$12.10	$0.00	$50.25
	06/01/2015	$31.35	$7.30	$12.10	$0.00	$50.75
	12/01/2015	$31.85	$7.30	$12.10	$0.00	$51.25
	06/01/2016	$32.35	$7.30	$12.10	$0.00	$51.75
	12/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 2*	12/01/2013	$30.05	$7.30	$12.05	$0.00	$49.40
	06/01/2014	$30.55	$7.30	$12.05	$0.00	$49.90
	12/01/2014	$31.05	$7.30	$12.05	$0.00	$50.40
	06/01/2015	$31.55	$7.30	$12.05	$0.00	$50.90
	12/01/2015	$32.05	$7.30	$12.05	$0.00	$51.40
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: MASON TENDER *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 2*	12/01/2013	$29.85	$7.30	$12.10	$0.00	$49.25
	06/01/2014	$30.35	$7.30	$12.10	$0.00	$49.75
	12/01/2014	$30.85	$7.30	$12.10	$0.00	$50.25
	06/01/2015	$31.35	$7.30	$12.10	$0.00	$50.75
	12/01/2015	$31.85	$7.30	$12.10	$0.00	$51.25
	06/01/2016	$32.35	$7.30	$12.10	$0.00	$51.75
	12/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 2*	12/01/2013	$29.85	$7.30	$12.10	$0.00	$49.25
	06/01/2014	$30.35	$7.30	$12.10	$0.00	$49.75
	12/01/2014	$30.85	$7.30	$12.10	$0.00	$50.25
	06/01/2015	$31.35	$7.30	$12.10	$0.00	$50.75
	12/01/2015	$31.85	$7.30	$12.10	$0.00	$51.25
	06/01/2016	$32.35	$7.30	$12.10	$0.00	$51.75
	12/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
This classification applies to all tree work associated with the removal of standing trees, and trimming and removal of branches and limbs when the work is not done for a utility company for the purpose of operation, maintenance or repair of utility company equipment. For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2014	$36.66	$10.18	$16.83	$0.00	$63.67
	08/01/2014	$37.37	$10.18	$16.90	$0.00	$64.45
	02/01/2015	$37.82	$10.18	$16.90	$0.00	$64.90
	08/01/2015	$38.53	$10.18	$16.97	$0.00	$65.68
	02/01/2016	$38.98	$10.18	$16.97	$0.00	$66.13
	08/01/2016	$39.68	$10.18	$17.05	$0.00	$66.91
	02/01/2017	$40.14	$10.18	$17.05	$0.00	$67.37

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE & TILE FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.33	$10.18	$16.83	$0.00	$45.34
2	60	$22.00	$10.18	$16.83	$0.00	$49.01
3	70	$25.66	$10.18	$16.83	$0.00	$52.67
4	80	$29.33	$10.18	$16.83	$0.00	$56.34
5	90	$32.99	$10.18	$16.83	$0.00	$60.00

Effective Date - 08/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.69	$10.18	$16.90	$0.00	$45.77
2	60	$22.42	$10.18	$16.90	$0.00	$49.50
3	70	$26.16	$10.18	$16.90	$0.00	$53.24
4	80	$29.90	$10.18	$16.90	$0.00	$56.98
5	90	$33.63	$10.18	$16.90	$0.00	$60.71

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2014	$48.10	$10.18	$18.15	$0.00	$76.43
	08/01/2014	$49.00	$10.18	$18.22	$0.00	$77.40
	02/01/2015	$49.56	$10.18	$18.22	$0.00	$77.96
	08/01/2015	$50.46	$10.18	$18.29	$0.00	$78.93
	02/01/2016	$51.03	$10.18	$18.29	$0.00	$79.50
	08/01/2016	$51.93	$10.18	$18.37	$0.00	$80.48
	02/01/2017	$52.50	$10.18	$18.37	$0.00	$81.05

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile*

Effective Date - 02/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.05	$10.18	$18.15	$0.00	$52.38
2	60	$28.86	$10.18	$18.15	$0.00	$57.19
3	70	$33.67	$10.18	$18.15	$0.00	$62.00
4	80	$38.48	$10.18	$18.15	$0.00	$66.81
5	90	$43.29	$10.18	$18.15	$0.00	$71.62

Effective Date - 08/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.50	$10.18	$18.22	$0.00	$52.90
2	60	$29.40	$10.18	$18.22	$0.00	$57.80
3	70	$34.30	$10.18	$18.22	$0.00	$62.70
4	80	$39.20	$10.18	$18.22	$0.00	$67.60
5	90	$44.10	$10.18	$18.22	$0.00	$72.50

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 2) *MILLWRIGHTS LOCAL 1121 - Zone 2*	04/01/2014	$33.16	$9.80	$16.21	$0.00	$59.17
	10/01/2014	$33.92	$9.80	$16.21	$0.00	$59.93
	04/01/2015	$34.69	$9.80	$16.21	$0.00	$60.70

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 2*

Effective Date - 04/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$18.24	$9.80	$4.48	$0.00	$32.52
2	65	$21.55	$9.80	$13.36	$0.00	$44.71
3	75	$24.87	$9.80	$14.18	$0.00	$48.85
4	85	$28.19	$9.80	$14.99	$0.00	$52.98

Effective Date - 10/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$18.66	$9.80	$4.48	$0.00	$32.94
2	65	$22.05	$9.80	$13.36	$0.00	$45.21
3	75	$25.44	$9.80	$14.18	$0.00	$49.42
4	85	$28.83	$9.80	$14.99	$0.00	$53.62

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$20.96	$10.00	$14.18	$0.00	$45.14
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$24.43	$10.00	$14.18	$0.00	$48.61
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2014	$45.91	$7.85	$16.10	$0.00	$69.86
	07/01/2014	$46.76	$7.85	$16.10	$0.00	$70.71
	01/01/2015	$47.66	$7.85	$16.10	$0.00	$71.61
	07/01/2015	$48.56	$7.85	$16.10	$0.00	$72.51
	01/01/2016	$49.51	$7.85	$16.10	$0.00	$73.46
	07/01/2016	$50.46	$7.85	$16.10	$0.00	$74.41
	01/01/2017	$51.41	$7.85	$16.10	$0.00	$75.36

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.96	$7.85	$0.00	$0.00	$30.81
2	55	$25.25	$7.85	$3.66	$0.00	$36.76
3	60	$27.55	$7.85	$3.99	$0.00	$39.39
4	65	$29.84	$7.85	$4.32	$0.00	$42.01
5	70	$32.14	$7.85	$14.11	$0.00	$54.10
6	75	$34.43	$7.85	$14.44	$0.00	$56.72
7	80	$36.73	$7.85	$14.77	$0.00	$59.35
8	90	$41.32	$7.85	$15.44	$0.00	$64.61

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.38	$7.85	$0.00	$0.00	$31.23
2	55	$25.72	$7.85	$3.66	$0.00	$37.23
3	60	$28.06	$7.85	$3.99	$0.00	$39.90
4	65	$30.39	$7.85	$4.32	$0.00	$42.56
5	70	$32.73	$7.85	$14.11	$0.00	$54.69
6	75	$35.07	$7.85	$14.44	$0.00	$57.36
7	80	$37.41	$7.85	$14.77	$0.00	$60.03
8	90	$42.08	$7.85	$15.44	$0.00	$65.37

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) *	01/01/2014	$36.81	$7.85	$16.10	$0.00	$60.76
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	07/01/2014	$37.66	$7.85	$16.10	$0.00	$61.61
	01/01/2015	$38.56	$7.85	$16.10	$0.00	$62.51
	07/01/2015	$39.46	$7.85	$16.10	$0.00	$63.41
	01/01/2016	$40.41	$7.85	$16.10	$0.00	$64.36
	07/01/2016	$41.36	$7.85	$16.10	$0.00	$65.31
	01/01/2017	$42.31	$7.85	$16.10	$0.00	$66.26

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - New*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.41	$7.85	$0.00	$0.00	$26.26
2	55	$20.25	$7.85	$3.66	$0.00	$31.76
3	60	$22.09	$7.85	$3.99	$0.00	$33.93
4	65	$23.93	$7.85	$4.32	$0.00	$36.10
5	70	$25.77	$7.85	$14.11	$0.00	$47.73
6	75	$27.61	$7.85	$14.44	$0.00	$49.90
7	80	$29.45	$7.85	$14.77	$0.00	$52.07
8	90	$33.13	$7.85	$15.44	$0.00	$56.42

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.83	$7.85	$0.00	$0.00	$26.68
2	55	$20.71	$7.85	$3.66	$0.00	$32.22
3	60	$22.60	$7.85	$3.99	$0.00	$34.44
4	65	$24.48	$7.85	$4.32	$0.00	$36.65
5	70	$26.36	$7.85	$14.11	$0.00	$48.32
6	75	$28.25	$7.85	$14.44	$0.00	$50.54
7	80	$30.13	$7.85	$14.77	$0.00	$52.75
8	90	$33.89	$7.85	$15.44	$0.00	$57.18

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2014	$34.87	$7.85	$16.10	$0.00	$58.82
	07/01/2014	$35.72	$7.85	$16.10	$0.00	$59.67
	01/01/2015	$36.62	$7.85	$16.10	$0.00	$60.57
	07/01/2015	$37.52	$7.85	$16.10	$0.00	$61.47
	01/01/2016	$38.47	$7.85	$16.10	$0.00	$62.42
	07/01/2016	$39.42	$7.85	$16.10	$0.00	$63.37
	01/01/2017	$40.37	$7.85	$16.10	$0.00	$64.32

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.44	$7.85	$0.00	$0.00	$25.29
2	55	$19.18	$7.85	$3.66	$0.00	$30.69
3	60	$20.92	$7.85	$3.99	$0.00	$32.76
4	65	$22.67	$7.85	$4.32	$0.00	$34.84
5	70	$24.41	$7.85	$14.11	$0.00	$46.37
6	75	$26.15	$7.85	$14.44	$0.00	$48.44
7	80	$27.90	$7.85	$14.77	$0.00	$50.52
8	90	$31.38	$7.85	$15.44	$0.00	$54.67

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.86	$7.85	$0.00	$0.00	$25.71
2	55	$19.65	$7.85	$3.66	$0.00	$31.16
3	60	$21.43	$7.85	$3.99	$0.00	$33.27
4	65	$23.22	$7.85	$4.32	$0.00	$35.39
5	70	$25.00	$7.85	$14.11	$0.00	$46.96
6	75	$26.79	$7.85	$14.44	$0.00	$49.08
7	80	$28.58	$7.85	$14.77	$0.00	$51.20
8	90	$32.15	$7.85	$15.44	$0.00	$55.44

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 2*	12/01/2013	$29.85	$7.30	$12.10	$0.00	$49.25
	06/01/2014	$30.35	$7.30	$12.10	$0.00	$49.75
	12/01/2014	$30.85	$7.30	$12.10	$0.00	$50.25
	06/01/2015	$31.35	$7.30	$12.10	$0.00	$50.75
	12/01/2015	$31.85	$7.30	$12.10	$0.00	$51.25
	06/01/2016	$32.35	$7.30	$12.10	$0.00	$51.75
	12/01/2016	$33.10	$7.30	$12.10	$0.00	$52.50
For Apprentice rates see "Apprentice- LABORER"						
PAINTER / TAPER (BRUSH, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2014	$35.41	$7.85	$16.10	$0.00	$59.36
	07/01/2014	$36.26	$7.85	$16.10	$0.00	$60.21
	01/01/2015	$37.16	$7.85	$16.10	$0.00	$61.11
	07/01/2015	$38.06	$7.85	$16.10	$0.00	$62.01
	01/01/2016	$39.01	$7.85	$16.10	$0.00	$62.96
	07/01/2016	$39.96	$7.85	$16.10	$0.00	$63.91
	01/01/2017	$40.91	$7.85	$16.10	$0.00	$64.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.71	$7.85	$0.00	$0.00	$25.56
2	55	$19.48	$7.85	$3.66	$0.00	$30.99
3	60	$21.25	$7.85	$3.99	$0.00	$33.09
4	65	$23.02	$7.85	$4.32	$0.00	$35.19
5	70	$24.79	$7.85	$14.11	$0.00	$46.75
6	75	$26.56	$7.85	$14.44	$0.00	$48.85
7	80	$28.33	$7.85	$14.77	$0.00	$50.95
8	90	$31.87	$7.85	$15.44	$0.00	$55.16

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.13	$7.85	$0.00	$0.00	$25.98
2	55	$19.94	$7.85	$3.66	$0.00	$31.45
3	60	$21.76	$7.85	$3.99	$0.00	$33.60
4	65	$23.57	$7.85	$4.32	$0.00	$35.74
5	70	$25.38	$7.85	$14.11	$0.00	$47.34
6	75	$27.20	$7.85	$14.44	$0.00	$49.49
7	80	$29.01	$7.85	$14.77	$0.00	$51.63
8	90	$32.63	$7.85	$15.44	$0.00	$55.92

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2014	$33.47	$7.85	$16.10	$0.00	$57.42
	07/01/2014	$34.32	$7.85	$16.10	$0.00	$58.27
	01/01/2015	$35.22	$7.85	$16.10	$0.00	$59.17
	07/01/2015	$36.12	$7.85	$16.10	$0.00	$60.07
	01/01/2016	$37.07	$7.85	$16.10	$0.00	$61.02
	07/01/2016	$38.02	$7.85	$16.10	$0.00	$61.97
	01/01/2017	$38.97	$7.85	$16.10	$0.00	$62.92

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 01/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$16.74	$7.85	$0.00	$0.00	$24.59
2	55	$18.41	$7.85	$3.66	$0.00	$29.92
3	60	$20.08	$7.85	$3.99	$0.00	$31.92
4	65	$21.76	$7.85	$4.32	$0.00	$33.93
5	70	$23.43	$7.85	$14.11	$0.00	$45.39
6	75	$25.10	$7.85	$14.44	$0.00	$47.39
7	80	$26.78	$7.85	$14.77	$0.00	$49.40
8	90	$30.12	$7.85	$15.44	$0.00	$53.41

Effective Date - 07/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.16	$7.85	$0.00	$0.00	$25.01
2	55	$18.88	$7.85	$3.66	$0.00	$30.39
3	60	$20.59	$7.85	$3.99	$0.00	$32.43
4	65	$22.31	$7.85	$4.32	$0.00	$34.48
5	70	$24.02	$7.85	$14.11	$0.00	$45.98
6	75	$25.74	$7.85	$14.44	$0.00	$48.03
7	80	$27.46	$7.85	$14.77	$0.00	$50.08
8	90	$30.89	$7.85	$15.44	$0.00	$54.18

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2012	$30.28	$9.07	$8.00	$0.00	$47.35
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2013	$40.10	$9.80	$18.17	$0.00	$68.07
	08/01/2014	$41.60	$9.80	$18.17	$0.00	$69.57
	08/01/2015	$43.10	$9.80	$18.17	$0.00	$71.07
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2013	$40.10	$9.80	$18.17	$0.00	$68.07
	08/01/2014	$41.60	$9.80	$18.17	$0.00	$69.57
	08/01/2015	$43.10	$9.80	$18.17	$0.00	$71.07

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PILE DRIVER - Local 56 Zone 1*

Effective Date - 08/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.05	$9.80	$18.17	$0.00	$48.02
2	60	$24.06	$9.80	$18.17	$0.00	$52.03
3	70	$28.07	$9.80	$18.17	$0.00	$56.04
4	75	$30.08	$9.80	$18.17	$0.00	$58.05
5	80	$32.08	$9.80	$18.17	$0.00	$60.05
6	80	$32.08	$9.80	$18.17	$0.00	$60.05
7	90	$36.09	$9.80	$18.17	$0.00	$64.06
8	90	$36.09	$9.80	$18.17	$0.00	$64.06

Effective Date - 08/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.80	$9.80	$18.17	$0.00	$48.77
2	60	$24.96	$9.80	$18.17	$0.00	$52.93
3	70	$29.12	$9.80	$18.17	$0.00	$57.09
4	75	$31.20	$9.80	$18.17	$0.00	$59.17
5	80	$33.28	$9.80	$18.17	$0.00	$61.25
6	80	$33.28	$9.80	$18.17	$0.00	$61.25
7	90	$37.44	$9.80	$18.17	$0.00	$65.41
8	90	$37.44	$9.80	$18.17	$0.00	$65.41

Notes:

Apprentice to Journeyworker Ratio:1:3

PIPEFITTER & STEAMFITTER *PIPEFITTERS LOCAL 537*	03/01/2013	$49.34	$8.75	$14.39	$0.00	$72.48

Apprentice - *PIPEFITTER - Local 537*

Effective Date - 03/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$19.74	$8.75	$6.50	$0.00	$34.99
2	45	$22.20	$8.75	$14.39	$0.00	$45.34
3	60	$29.60	$8.75	$14.39	$0.00	$52.74
4	70	$34.54	$8.75	$14.39	$0.00	$57.68
5	80	$39.47	$8.75	$14.39	$0.00	$62.61

Notes:

** 1:3; 3:15; 1:10 thereafter / Steps are 1 yr.
Refrig/AC Mechanic **1:1;1:2;2:4;3:6;4:8;5:10;6:12;7:14;8:17;9:20;10:23(Max)

Apprentice to Journeyworker Ratio:**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PIPELAYER *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
PLUMBERS & GASFITTERS *PLUMBERS & GASFITTERS LOCAL 12*	03/01/2014	$49.41	$9.82	$14.29	$0.00	$73.52
	09/01/2014	$50.41	$9.82	$14.29	$0.00	$74.52
	03/01/2015	$51.41	$9.82	$14.29	$0.00	$75.52
	09/01/2015	$52.41	$9.82	$14.29	$0.00	$76.52
	03/01/2016	$53.56	$9.82	$14.29	$0.00	$77.67
	09/01/2016	$54.61	$9.82	$14.29	$0.00	$78.72
	03/01/2017	$55.61	$9.82	$14.29	$0.00	$79.72

Apprentice - *PLUMBER/GASFITTER - Local 12*

Effective Date - 03/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$17.29	$9.82	$5.33	$0.00	$32.44
2	40	$19.76	$9.82	$6.02	$0.00	$35.60
3	55	$27.18	$9.82	$8.08	$0.00	$45.08
4	65	$32.12	$9.82	$9.47	$0.00	$51.41
5	75	$37.06	$9.82	$10.85	$0.00	$57.73

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$17.64	$9.82	$5.33	$0.00	$32.79
2	40	$20.16	$9.82	$6.02	$0.00	$36.00
3	55	$27.73	$9.82	$8.08	$0.00	$45.63
4	65	$32.77	$9.82	$9.47	$0.00	$52.06
5	75	$37.81	$9.82	$10.85	$0.00	$58.48

Notes:

** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic$54.58 Step5 with lic$60.90

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) *PIPEFITTERS LOCAL 537*	03/01/2013	$49.34	$8.75	$14.39	$0.00	$72.48

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER *LABORERS - ZONE 2*	12/01/2013	$30.85	$7.30	$12.10	$0.00	$50.25
	06/01/2014	$31.35	$7.30	$12.10	$0.00	$50.75
	12/01/2014	$31.85	$7.30	$12.10	$0.00	$51.25
	06/01/2015	$32.35	$7.30	$12.10	$0.00	$51.75
	12/01/2015	$32.85	$7.30	$12.10	$0.00	$52.25
	06/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
	12/01/2016	$34.10	$7.30	$12.10	$0.00	$53.50
For apprentice rates see "Apprentice- LABORER"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.49	$10.00	$14.18	$0.00	$64.67
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.49	$10.00	$14.18	$0.00	$64.67
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$28.11	$10.00	$14.18	$0.00	$52.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER *TEAMSTERS LOCAL 170*	05/01/2010	$22.04	$6.50	$5.44	$0.00	$33.98
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RESIDENTIAL WOOD FRAME (All Other Work) *CARPENTERS -ZONE 2 (Residential Wood)*	04/01/2011	$24.24	$8.67	$15.51	$0.00	$48.42
RESIDENTIAL WOOD FRAME CARPENTER ** ** The Residential Wood Frame Carpenter classification applies only to the construction of new, wood frame residences that do not exceed four stories including the basement.*CARPENTERS -ZONE 2 (Residential Wood)*	05/01/2011	$24.24	$6.34	$6.23	$0.00	$36.81

As of 9/1/09 Carpentry work on wood-frame residential WEATHERIZATION projects shall be paid the RESIDENTIAL WOOD FRAME CARPENTER rate.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER (Residential Wood Frame) - Zone 2*

Effective Date - 05/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$14.54	$6.34	$0.00	$0.00	$20.88
2	60	$14.54	$6.34	$6.23	$0.00	$27.11
3	65	$15.76	$6.34	$6.23	$0.00	$28.33
4	70	$16.97	$6.34	$6.23	$0.00	$29.54
5	75	$18.18	$6.34	$6.23	$0.00	$30.75
6	80	$19.39	$6.34	$6.23	$0.00	$31.96
7	85	$20.60	$6.34	$6.23	$0.00	$33.17
8	90	$21.82	$6.34	$6.23	$0.00	$34.39

Notes:

Apprentice to Journeyworker Ratio:1:5

RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	02/01/2014	$39.21	$10.50	$10.70	$0.00	$60.41
	08/01/2014	$40.11	$10.50	$10.70	$0.00	$61.31
	02/01/2015	$41.01	$10.50	$10.70	$0.00	$62.21
	08/01/2015	$41.91	$10.50	$10.70	$0.00	$63.11
	02/01/2016	$42.81	$10.50	$10.70	$0.00	$64.01

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ROOFER - Local 33*

Effective Date - 02/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.61	$10.50	$3.38	$0.00	$33.49
2	60	$23.53	$10.50	$10.70	$0.00	$44.73
3	65	$25.49	$10.50	$10.70	$0.00	$46.69
4	75	$29.41	$10.50	$10.70	$0.00	$50.61
5	85	$33.33	$10.50	$10.70	$0.00	$54.53

Effective Date - 08/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.06	$10.50	$3.38	$0.00	$33.94
2	60	$24.07	$10.50	$10.70	$0.00	$45.27
3	65	$26.07	$10.50	$10.70	$0.00	$47.27
4	75	$30.08	$10.50	$10.70	$0.00	$51.28
5	85	$34.09	$10.50	$10.70	$0.00	$55.29

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	02/01/2014	$39.46	$10.50	$10.70	$0.00	$60.66
	08/01/2014	$40.36	$10.50	$10.70	$0.00	$61.56
	02/01/2015	$41.26	$10.50	$10.70	$0.00	$62.46
	08/01/2015	$42.16	$10.50	$10.70	$0.00	$63.36
	02/01/2016	$43.06	$10.50	$10.70	$0.00	$64.26
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2014	$42.76	$9.82	$19.74	$2.17	$74.49
	08/01/2014	$43.61	$9.82	$19.74	$2.17	$75.34
	02/01/2015	$44.51	$9.82	$19.74	$2.17	$76.24
	08/01/2015	$45.51	$9.82	$19.74	$2.17	$77.24
	02/01/2016	$46.51	$9.82	$19.74	$2.17	$78.24
	08/01/2016	$47.66	$9.82	$19.74	$2.17	$79.39
	02/01/2017	$48.76	$9.82	$19.74	$2.17	$80.49
	08/01/2017	$49.86	$9.82	$19.74	$2.17	$81.59
	02/01/2018	$51.01	$9.82	$19.74	$2.17	$82.74

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SHEET METAL WORKER - Local 17-A*

Effective Date - 02/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.10	$9.82	$4.28	$0.00	$31.20
2	40	$17.10	$9.82	$4.28	$0.00	$31.20
3	45	$19.24	$9.82	$8.70	$1.13	$38.89
4	45	$19.24	$9.82	$8.70	$1.13	$38.89
5	50	$21.38	$9.82	$9.49	$1.22	$41.91
6	50	$21.38	$9.82	$9.74	$1.23	$42.17
7	60	$25.66	$9.82	$11.05	$1.40	$47.93
8	65	$27.79	$9.82	$11.84	$1.48	$50.93
9	75	$32.07	$9.82	$13.41	$1.66	$56.96
10	85	$36.35	$9.82	$14.48	$1.82	$62.47

Effective Date - 08/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.44	$9.82	$4.28	$0.00	$31.54
2	40	$17.44	$9.82	$4.28	$0.00	$31.54
3	45	$19.62	$9.82	$8.70	$1.13	$39.27
4	45	$19.62	$9.82	$8.70	$1.13	$39.27
5	50	$21.81	$9.82	$9.49	$1.22	$42.34
6	50	$21.81	$9.82	$9.74	$1.23	$42.60
7	60	$26.17	$9.82	$11.05	$1.40	$48.44
8	65	$28.35	$9.82	$11.84	$1.48	$51.49
9	75	$32.71	$9.82	$13.41	$1.66	$57.60
10	85	$37.07	$9.82	$14.48	$1.82	$63.19

Notes:
Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SIGN ERECTOR *PAINTERS LOCAL 35 - ZONE 2*	06/01/2013	$25.81	$7.07	$7.05	$0.00	$39.93

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SIGN ERECTOR - Local 35 Zone 2*

Effective Date - 06/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$12.91	$7.07	$0.00	$0.00	$19.98
2	55	$14.20	$7.07	$2.45	$0.00	$23.72
3	60	$15.49	$7.07	$2.45	$0.00	$25.01
4	65	$16.78	$7.07	$2.45	$0.00	$26.30
5	70	$18.07	$7.07	$7.05	$0.00	$32.19
6	75	$19.36	$7.07	$7.05	$0.00	$33.48
7	80	$20.65	$7.07	$7.05	$0.00	$34.77
8	85	$21.94	$7.07	$7.05	$0.00	$36.06
9	90	$23.23	$7.07	$7.05	$0.00	$37.35

Notes:
Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2013	$31.24	$9.41	$8.80	$0.00	$49.45
	06/01/2014	$31.59	$9.41	$8.80	$0.00	$49.80
	08/01/2014	$31.59	$9.91	$8.80	$0.00	$50.30
	12/01/2014	$31.59	$9.91	$9.33	$0.00	$50.83
	06/01/2015	$31.94	$9.91	$9.33	$0.00	$51.18
	08/01/2015	$31.94	$10.41	$9.33	$0.00	$51.68
	12/01/2015	$31.94	$10.41	$10.08	$0.00	$52.43
	06/01/2016	$32.44	$10.41	$10.08	$0.00	$52.93
	08/01/2016	$32.44	$10.91	$10.08	$0.00	$53.43
	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2013	$31.53	$9.41	$8.80	$0.00	$49.74
	06/01/2014	$31.88	$9.41	$8.80	$0.00	$50.09
	08/01/2014	$31.88	$9.91	$8.80	$0.00	$50.59
	12/01/2014	$31.88	$9.91	$9.33	$0.00	$51.12
	06/01/2015	$32.23	$9.91	$9.33	$0.00	$51.47
	08/01/2015	$32.23	$10.41	$9.33	$0.00	$51.97
	12/01/2015	$32.23	$10.41	$10.08	$0.00	$52.72
	06/01/2016	$32.73	$10.41	$10.08	$0.00	$53.22
	08/01/2016	$32.73	$10.91	$10.08	$0.00	$53.72
	12/01/2016	$32.73	$10.91	$10.89	$0.00	$54.53

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	03/01/2014	$53.58	$8.42	$13.60	$0.00	$75.60
	10/01/2014	$54.73	$8.42	$13.60	$0.00	$76.75
	01/01/2015	$54.73	$8.42	$13.75	$0.00	$76.90
	03/01/2015	$55.73	$8.42	$13.75	$0.00	$77.90
	10/01/2015	$56.88	$8.42	$13.75	$0.00	$79.05
	01/01/2016	$56.88	$8.67	$13.90	$0.00	$79.45
	03/01/2016	$57.88	$8.67	$13.90	$0.00	$80.45
	10/01/2016	$59.03	$8.67	$13.90	$0.00	$81.60
	03/01/2017	$60.03	$8.67	$13.90	$0.00	$82.60

Apprentice - *SPRINKLER FITTER - Local 550 (Section A) Zone 1*

Effective Date - 03/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$18.75	$8.42	$8.25	$0.00	$35.42
2	40	$21.43	$8.42	$8.25	$0.00	$38.10
3	45	$24.11	$8.42	$8.25	$0.00	$40.78
4	50	$26.79	$8.42	$8.25	$0.00	$43.46
5	55	$29.47	$8.42	$8.25	$0.00	$46.14
6	60	$32.15	$8.42	$8.25	$0.00	$48.82
7	65	$34.83	$8.42	$8.25	$0.00	$51.50
8	70	$37.51	$8.42	$8.25	$0.00	$54.18
9	75	$40.19	$8.42	$8.25	$0.00	$56.86
10	80	$42.86	$8.42	$8.25	$0.00	$59.53

Effective Date - 10/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.16	$8.42	$8.25	$0.00	$35.83
2	40	$21.89	$8.42	$8.25	$0.00	$38.56
3	45	$24.63	$8.42	$8.25	$0.00	$41.30
4	50	$27.37	$8.42	$8.25	$0.00	$44.04
5	55	$30.10	$8.42	$8.25	$0.00	$46.77
6	60	$32.84	$8.42	$8.25	$0.00	$49.51
7	65	$35.57	$8.42	$8.25	$0.00	$52.24
8	70	$38.31	$8.42	$8.25	$0.00	$54.98
9	75	$41.05	$8.42	$8.25	$0.00	$57.72
10	80	$43.78	$8.42	$8.25	$0.00	$60.45

Notes: Apprentice entered prior 9/30/10:
40/45/50/55/60/65/70/75/80/85
Steps are 850 hours

Apprentice to Journeyworker Ratio:1:3

STEAM BOILER OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2014	$47.00	$10.18	$18.15	$0.00	$75.33
	08/01/2014	$47.90	$10.18	$18.22	$0.00	$76.30
	02/01/2015	$48.46	$10.18	$18.22	$0.00	$76.86
	08/01/2015	$49.36	$10.18	$18.29	$0.00	$77.83
	02/01/2016	$49.93	$10.18	$18.29	$0.00	$78.40
	08/01/2016	$50.83	$10.18	$18.37	$0.00	$79.38
	02/01/2017	$51.40	$10.18	$18.37	$0.00	$79.95

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.50	$10.18	$18.15	$0.00	$51.83
2	60	$28.20	$10.18	$18.15	$0.00	$56.53
3	70	$32.90	$10.18	$18.15	$0.00	$61.23
4	80	$37.60	$10.18	$18.15	$0.00	$65.93
5	90	$42.30	$10.18	$18.15	$0.00	$70.63

Effective Date - 08/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.95	$10.18	$18.22	$0.00	$52.35
2	60	$28.74	$10.18	$18.22	$0.00	$57.14
3	70	$33.53	$10.18	$18.22	$0.00	$61.93
4	80	$38.32	$10.18	$18.22	$0.00	$66.72
5	90	$43.11	$10.18	$18.22	$0.00	$71.51

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2013	$34.70	$7.30	$12.90	$0.00	$54.90
	06/01/2014	$35.45	$7.30	$12.90	$0.00	$55.65
	12/01/2014	$36.20	$7.30	$12.90	$0.00	$56.40
	06/01/2015	$36.95	$7.30	$12.90	$0.00	$57.15
	12/01/2015	$37.70	$7.30	$12.90	$0.00	$57.90
	06/01/2016	$38.45	$7.30	$12.90	$0.00	$58.65
	12/01/2016	$39.45	$7.30	$12.90	$0.00	$59.65
For apprentice rates see "Apprentice- LABORER"						
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2013	$33.42	$7.30	$12.90	$0.00	$53.62
	06/01/2014	$34.17	$7.30	$12.90	$0.00	$54.37
	12/01/2014	$34.92	$7.30	$12.90	$0.00	$55.12
	06/01/2015	$35.67	$7.30	$12.90	$0.00	$55.87
	12/01/2015	$36.42	$7.30	$12.90	$0.00	$56.62
	06/01/2016	$37.17	$7.30	$12.90	$0.00	$57.37
	12/01/2016	$38.17	$7.30	$12.90	$0.00	$58.37
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2013	$33.30	$7.30	$12.90	$0.00	$53.50
	06/01/2014	$34.05	$7.30	$12.90	$0.00	$54.25
	12/01/2014	$34.80	$7.30	$12.90	$0.00	$55.00
	06/01/2015	$35.55	$7.30	$12.90	$0.00	$55.75
	12/01/2015	$36.30	$7.30	$12.90	$0.00	$56.50
	06/01/2016	$37.05	$7.30	$12.90	$0.00	$57.25
	12/01/2016	$38.05	$7.30	$12.90	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.11	$10.00	$14.18	$0.00	$64.29
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2013	$31.82	$9.41	$8.80	$0.00	$50.03
	06/01/2014	$32.17	$9.41	$8.80	$0.00	$50.38
	08/01/2014	$32.17	$9.91	$8.80	$0.00	$50.88
	12/01/2014	$32.17	$9.91	$9.33	$0.00	$51.41
	06/01/2015	$32.52	$9.91	$9.33	$0.00	$51.76
	08/01/2015	$32.52	$10.41	$9.33	$0.00	$52.26
	12/01/2015	$32.52	$10.41	$10.08	$0.00	$53.01
	06/01/2016	$33.02	$10.41	$10.08	$0.00	$53.51
	08/01/2016	$33.02	$10.91	$10.08	$0.00	$54.01
	12/01/2016	$33.02	$10.91	$10.89	$0.00	$54.82
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2013	$45.58	$7.30	$13.30	$0.00	$66.18
	06/01/2014	$46.33	$7.30	$13.30	$0.00	$66.93
	12/01/2014	$47.08	$7.30	$13.30	$0.00	$67.68
	06/01/2015	$47.83	$7.30	$13.30	$0.00	$68.43
	12/01/2015	$48.58	$7.30	$13.30	$0.00	$69.18
	06/01/2016	$49.33	$7.30	$13.30	$0.00	$69.93
	12/01/2016	$50.33	$7.30	$13.30	$0.00	$70.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2013	$47.58	$7.30	$13.30	$0.00	$68.18
	06/01/2014	$48.33	$7.30	$13.30	$0.00	$68.93
	12/01/2014	$49.08	$7.30	$13.30	$0.00	$69.68
	06/01/2015	$49.83	$7.30	$13.30	$0.00	$70.43
	12/01/2015	$50.58	$7.30	$13.30	$0.00	$71.18
	06/01/2016	$51.33	$7.30	$13.30	$0.00	$71.93
	12/01/2016	$52.33	$7.30	$13.30	$0.00	$72.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2013	$37.65	$7.30	$13.30	$0.00	$58.25
	06/01/2014	$38.40	$7.30	$13.30	$0.00	$59.00
	12/01/2014	$39.15	$7.30	$13.30	$0.00	$59.75
	06/01/2015	$39.90	$7.30	$13.30	$0.00	$60.50
	12/01/2015	$40.65	$7.30	$13.30	$0.00	$61.25
	06/01/2016	$41.40	$7.30	$13.30	$0.00	$62.00
	12/01/2016	$42.40	$7.30	$13.30	$0.00	$63.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2013	$39.65	$7.30	$13.30	$0.00	$60.25
	06/01/2014	$40.40	$7.30	$13.30	$0.00	$61.00
	12/01/2014	$41.15	$7.30	$13.30	$0.00	$61.75
	06/01/2015	$41.90	$7.30	$13.30	$0.00	$62.50
	12/01/2015	$42.65	$7.30	$13.30	$0.00	$63.25
	06/01/2016	$43.40	$7.30	$13.30	$0.00	$64.00
	12/01/2016	$44.40	$7.30	$13.30	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2013	$31.24	$9.41	$8.80	$0.00	$49.45
	06/01/2014	$31.59	$9.41	$8.80	$0.00	$49.80
	08/01/2014	$31.59	$9.91	$8.80	$0.00	$50.30
	12/01/2014	$31.59	$9.91	$9.33	$0.00	$50.83
	06/01/2015	$31.94	$9.91	$9.33	$0.00	$51.18
	08/01/2015	$31.94	$10.41	$9.33	$0.00	$51.68
	12/01/2015	$31.94	$10.41	$10.08	$0.00	$52.43
	06/01/2016	$32.44	$10.41	$10.08	$0.00	$52.93
	08/01/2016	$32.44	$10.91	$10.08	$0.00	$53.43
	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24
VOICE-DATA-VIDEO TECHNICIAN *ELECTRICIANS LOCAL 96*	06/01/2013	$25.86	$7.66	$10.09	$0.00	$43.61

Apprentice - *VOICE-DATA-VIDEO TECHNICIAN - Local 96*

Effective Date - 06/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$12.93	$7.66	$2.85	$0.00	$23.44
2	55	$14.22	$7.66	$2.89	$0.00	$24.77
3	60	$15.52	$7.66	$9.78	$0.00	$32.96
4	65	$16.81	$7.66	$9.81	$0.00	$34.28
5	70	$18.10	$7.66	$9.85	$0.00	$35.61
6	75	$19.40	$7.66	$9.89	$0.00	$36.95
7	80	$20.69	$7.66	$9.93	$0.00	$38.28
8	85	$21.98	$7.66	$9.97	$0.00	$39.61

Notes:

Apprentice to Journeyworker Ratio:1:1

WAGON DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2013	$30.10	$7.30	$12.10	$0.00	$49.50
	06/01/2014	$30.60	$7.30	$12.10	$0.00	$50.00
	12/01/2014	$31.10	$7.30	$12.10	$0.00	$50.50
	06/01/2015	$31.60	$7.30	$12.10	$0.00	$51.00
	12/01/2015	$32.10	$7.30	$12.10	$0.00	$51.50
	06/01/2016	$32.60	$7.30	$12.10	$0.00	$52.00
	12/01/2016	$33.35	$7.30	$12.10	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
WASTE WATER PUMP OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2013	$40.49	$10.00	$14.18	$0.00	$64.67
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER *PLUMBERS & GASFITTERS LOCAL 12*	03/01/2014	$49.41	$9.82	$14.29	$0.00	$73.52
	09/01/2014	$50.41	$9.82	$14.29	$0.00	$74.52
	03/01/2015	$51.41	$9.82	$14.29	$0.00	$75.52
	09/01/2015	$52.41	$9.82	$14.29	$0.00	$76.52
	03/01/2016	$53.56	$9.82	$14.29	$0.00	$77.67
	09/01/2016	$54.61	$9.82	$14.29	$0.00	$78.72
	03/01/2017	$55.61	$9.82	$14.29	$0.00	$79.72
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$25.66	$8.70	$4.48	$0.00	$38.84
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$36.55	$8.70	$6.58	$0.00	$51.83
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$29.94	$8.70	$6.05	$0.00	$44.69
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$23.52	$8.70	$5.24	$0.00	$37.46
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$36.35	$8.70	$9.43	$0.00	$54.48
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$32.08	$8.70	$6.59	$0.00	$47.37
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$23.52	$8.70	$3.72	$0.00	$35.94
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$19.25	$8.70	$2.85	$0.00	$30.80
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$42.77	$8.70	$11.78	$0.00	$63.25

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 09/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$25.66	$8.70	$4.24	$0.00	$38.60
2	65	$27.80	$8.70	$4.71	$0.00	$41.21
3	70	$29.94	$8.70	$5.43	$0.00	$44.07
4	75	$32.08	$8.70	$6.16	$0.00	$46.94
5	80	$34.22	$8.70	$6.88	$0.00	$49.80
6	85	$36.35	$8.70	$7.62	$0.00	$52.67
7	90	$38.49	$8.70	$8.83	$0.00	$56.02

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	07/16/2012	$26.33	$4.18	$2.79	$0.00	$33.30
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	07/16/2012	$24.78	$4.18	$2.74	$0.00	$31.70
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	07/16/2012	$24.78	$4.18	$2.74	$0.00	$31.70
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/29/2012	$17.18	$3.37	$0.00	$0.00	$20.55

This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is not on the ground. This classification does not apply to wholesale tree removal.

TREE TRIMMER GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/29/2012	$15.15	$3.37	$0.00	$0.00	$18.52

This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is on the ground. This classification does not apply to wholesale tree removal.

Additional Apprentice Information:

Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the pre-determined hourly wage rate established by the Commissioner under the provisions of the M.G.L. c. 149, ss. 26-27D. Apprentice ratios are established by the Division of Apprenticeship Training pursuant to M.G.L. c. 23, ss. 11E-11L.

All apprentices must be registered with the Division of Apprenticeship Training in accordance with M.G.L. c. 23, ss. 11E-11L.

All steps are six months (1000 hours) unless otherwise specified.

* Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof.
** Multiple ratios are listed in the comment field.
*** APP to JM; 1:1, 2:2, 2:3, 3:4, 4:4, 4:5, 4:6, 5:7, 6:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.
**** APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.

Appendix C: Statutory References

APPENDIX C

STATUTORY REFERENCS

PAYMENT PROCEDURES

MGL Chapter 30, Section 39F. (1) Every contract awarded pursuant to sections forty-four A to L, inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed

prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as

provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority or which are on deposit pursuant to subparagraph (f) of paragraph (1) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) "Subcontractor" as used in this section (i) for contracts awarded as provided in sections forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (a) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the awarding authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to

the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1).

(5) In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1) any amount held under a trustee writ or pursuant to a restraining order or injunction.

MGL Chapter 30, Section 39G. Upon substantial completion of the work required by a contract with the commonwealth, or any agency or political subdivision thereof, for the construction, reconstruction, alteration, remodeling, repair or improvement of public ways, including bridges and other highway structures, sewers and, water mains, airports and other public works, the contractor shall present in writing to the awarding authority its certification that the work has been substantially completed. Within twenty-one days thereafter, the awarding authority shall present to the contractor either a written declaration that the work has been substantially completed or an itemized list of incomplete or unsatisfactory work items required by the contract sufficient to demonstrate that the work has not been substantially completed. The awarding authority may include with such list a notice setting forth a reasonable time, which shall not in any event be prior to the contract completion date, within which the contractor must achieve substantial completion of the work. In the event that the awarding authority fails to respond, by presentation of a written declaration or itemized list as aforesaid, to the contractor's certification within the twenty-one day period, the contractor's certification shall take effect as the awarding authority's declaration that the work has been substantially completed.

Within sixty-five days after the effective date of a declaration of a substantial completion, the awarding authority shall prepare and forthwith send to the contractor for acceptance a substantial completion estimate for the quantity and price of the work done and all but one per cent retainage on that work, including the quantity, price and all but one per cent retainage for the undisputed part of each work item and extra work item in dispute but excluding the disputed part thereof, less the estimated cost of completing all incomplete and unsatisfactory work items and less the total periodic payments made to date for the work. The awarding authority also shall deduct from the substantial completion estimate an amount equal to the sum of all demands for direct payment filed by subcontractors and not yet paid to subcontractors or deposited in joint accounts pursuant to section thirty-nine F, but no contract subject to said section thirty-nine F shall contain any other provision authorizing the awarding authority to deduct any amount by virtue of claims asserted against the contract by subcontractors, material suppliers or others.

If the awarding authority fails to prepare and send to the contractor any substantial completion estimate required by this section on or before the date herein above set forth, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such substantial completion estimate at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston from such date to the date on which the awarding authority sends that substantial completion estimate to the contractor for acceptance or to the date of payment therefor, whichever occurs first. The awarding authority shall include the amount of such interest in the substantial completion estimate.

Within fifteen days after the effective date of the declaration of substantial completion, the awarding authority shall send to the contractor by certified mail, return receipt requested, a complete list of all incomplete or unsatisfactory work items, and, unless delayed by causes beyond his control, the contractor shall complete all such work items within forty-five days after the receipt of such list or before the then contract completion date, whichever is later. If the contractor fails to complete such work within such time, the awarding authority may, subsequent to seven days' written notice to the contractor by certified mail, return receipt requested, terminate the contract and complete the incomplete or unsatisfactory work items and charge the cost of same to the contractor.

Within thirty days after receipt by the awarding authority of a notice from the contractor stating that all of the work required by the contract has been completed, the awarding authority shall prepare and forthwith send to the contractor for acceptance a final estimate for the quantity and price of the work done and all retainage on that work less all payments made to date, unless the awarding authority's inspection shows that work items required by the contract remain incomplete or unsatisfactory, or that documentation required by the contract has not been completed. If the awarding authority fails to prepare and send to the contractor the final estimate within thirty days after receipt of notice of completion, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such final estimate at the rate hereinabove provided from the thirtieth day after such completion until the date on which the awarding authority sends the final estimate to the contractor for acceptance or the date of payment therefor, whichever occurs first, provided that the awarding authority's inspection shows that no work items required by the contract remain incomplete or unsatisfactory. Interest shall not be paid hereunder on amounts for which interest is required to be paid in connection with the substantial completion estimate as hereinabove provided. The awarding authority shall include the amount of the interest required to be paid hereunder in the final estimate.

The awarding authority shall pay the amount due pursuant to any substantial completion or final estimate within thirty-five days after receipt of written acceptance for such estimate from the contractor and shall pay interest on the amount due pursuant to such estimate at the rate hereinabove provided from that thirty-fifth day to the date of payment. Within 15 days, 30 days in the case of the commonwealth, after receipt from the contractor, at the place designated by the awarding authority, if such place is so designated, of a periodic estimate requesting payment of the amount due for the preceding periodic estimate period, the awarding authority shall make a periodic payment to the contractor for the work performed during the preceding periodic estimate period and for the materials not incorporated in the work but delivered and suitably stored at the site, or at some location agreed upon in writing, to which the contractor has title or to which a subcontractor has title and has authorized the contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances. The awarding authority shall include with each such payment interest on the amount due pursuant to such periodic estimate at the rate herein above provided from the due date. In the case of periodic payments, the contracting authority may deduct from its payment a retention based on its estimate of the fair value of its claims against the contractor, a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and a retention to secure satisfactory performance of the contractual work not exceeding five per cent of the approved amount of any periodic payment, and the same right to retention shall apply to bonded subcontractors entitled to direct payment under section thirty-nine F of chapter thirty; provided, that a five per cent value of all items that are planted in the ground shall be deducted from the periodic payments until final acceptance.

No periodic, substantial completion or final estimate or acceptance or payment thereof shall bar a contractor from reserving all rights to dispute the quantity and amount of, or the failure of the awarding authority to approve a quantity and amount of, all or part of any work item or extra work item.

Substantial completion, for the purposes of this section, shall mean either that the work required by the contract has been completed except for work having a contract price of less than one per cent of the then adjusted total contract price, or substantially all of the work has been completed and opened to public use except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the work required by the contract.

MGL Chapter 30, Section 39K. Every contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building by the commonwealth, or by any county, city, town, district, board, commission or other public body, when the amount is more than five thousand dollars in the case of the commonwealth and more than two thousand dollars in the case of any county, city, town, district, board, commission or other public body, shall contain the following paragraph:— Within fifteen days (30 days in the case of the commonwealth, including local housing authorities) after receipt from the contractor, at the place designated by the awarding authority if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the awarding authority will make a periodic payment to the contractor for the work performed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the contractor has title or to which a subcontractor has title and has authorized the contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances, but less (1) a retention based on its estimate of the fair value of its claims against the contractor and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and less (3) a retention not exceeding five per cent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one per cent of the original contract price, or (b) the contractor substantially completes the work and the awarding authority takes possession for occupancy, whichever occurs first, the awarding authority shall pay the contractor the entire balance due on the contract less (1) a retention based on its estimate of the fair value of its claims against the contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, or based on the record of payments by the contractor to the subcontractors under this contract if such record of payment indicates that the contractor has not paid subcontractors as provided in section thirty-nine F. If the awarding authority fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate than charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the contractor; provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for final payment until fifteen days (twenty-four days in the case of the commonwealth) after receipt of such a periodic estimate from the contractor, at the place designated by the awarding authority if such a place is so designated. The contractor agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

The awarding authority may make changes in any periodic estimate submitted by the contractor and the payment due on said periodic estimate shall be computed in accordance with the changes so made, but such changes or any requirement for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided, that the awarding authority may, within seven days after receipt, return to the contractor for correction, any periodic estimate which is not in the required form or which contains computations not arithmetically correct and, in that event, the date of receipt of such periodic estimate shall be the date of receipt of the corrected periodic estimate in proper form and with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter. The provisions of section thirty-nine G shall not apply to any contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building to which this section applies.

All periodic estimates shall be submitted to the awarding authority, or to its designee as set forth in writing to the contractor, and the date of receipt by the awarding authority or its designee shall be marked on the estimate. All periodic estimates shall contain a separate item for each filed subtrade and each sub-subtrade listed in sub-bid form as required by specifications and a column listing the amount paid to each subcontractor and sub-subcontractor as of the date the periodic estimate is filed. The person making payment for the awarding authority shall add the daily interest provided for herein to each payment for each day beyond the due date based on the date of receipt marked on the estimate.

A certificate of the architect to the effect that the contractor has fully or substantially completed the work shall, subject to the provisions of section thirty-nine J, be conclusive for the purposes of this section.

Notwithstanding the provisions of this section, at any time after the value of the work remaining to be done is, in the estimation of the awarding authority, less than 1 per cent of the adjusted contract price, or the awarding authority has determined that the contractor has substantially completed the work and the awarding authority has taken possession for occupancy, the awarding authority may send to the general contractor by certified mail, return receipt requested, a complete and final list of all incomplete and unsatisfactory work items, including, for each item on the list, a good faith estimate of the fair and reasonable cost of completing such item. The general contractor shall then complete all such work items within 30 days of receipt of such list or before the contract completion date, whichever is later. If the general contractor fails to complete all incomplete and unsatisfactory work items within 45 days after receipt of such items furnished by the awarding authority or before the contract completion date, whichever is later, subsequent to an additional 14 days' written notice to the general contractor by certified mail, return receipt requested, the awarding authority may terminate the contract and complete the incomplete and unsatisfactory work items and charge the cost of same to the general contractor and such termination shall be without prejudice to any other rights or remedies the awarding authority may have under the contract. The awarding authority shall note any such termination in the evaluation form to be filed by the awarding authority pursuant to the provisions of section 44D of chapter 149.

Appendix D: Order Of Conditions

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
212-1125
MassDEP File #

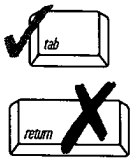
eDEP Transaction #

Marlborough
City/Town

A. General Information

Please note: this form has been modified with added space to accommodate the Registry of Deeds Requirements

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. From: Marlborough
Conservation Commission

2. This issuance is for (check one): a. ☑ Order of Conditions b. ☐ Amended Order of Conditions

3. To: Applicant:

John
a. First Name

Ghiloni
b. Last Name

Marlborough Dept. of Public Works
c. Organization

135 Neil Street
d. Mailing Address

Marlborough
e. City/Town

MA
f. State

01752
g. Zip Code

4. Property Owner (if different from applicant):

a. First Name

b. Last Name

c. Organization

d. Mailing Address

e. City/Town

f. State

g. Zip Code

5. Project Location:

Simarano Dr.
a. Street Address

Marlborough
b. City/Town

c. Assessors Map/Plat Number

d. Parcel/Lot Number

Latitude and Longitude, if known: d m s
d. Latitude

d m s
e. Longitude

A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):

a. County

b. Certificate Number (if registered land)

c. Book

d. Page

7. Dates: 2/11/2014 (a. Date Notice of Intent Filed) 3/20/2014 (b. Date Public Hearing Closed) 4/16/2014 (c. Date of Issuance)

8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):
Marlborough Simarano Dr. Drainage Areas Sheet 1thru 8 – Simarano Dr. Roadway Improvement Project Dated Feb. 2014
Vanasse Hangen Brustlin, Inc.
b. Prepared By

c. Signed and Stamped by

d. Final Revision Date

e. Scale

f. Additional Plan or Document Title

g. Date

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:

Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:

a. ☑ Public Water Supply b. ☐ Land Containing Shellfish c. ☑ Prevention of Pollution

d. ☐ Private Water Supply e. ☐ Fisheries f. ☐ Protection of Wildlife Habitat

g. ☐ Groundwater Supply h. ☑ Storm Damage Prevention i. ☑ Flood Control

2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

a. ☑ the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

B. Findings (cont.)

Denied because:

b. ☐ the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3. ☑ Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) — 20' (a. linear feet)

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☐ Bank	a. linear feet	b. linear feet	c. linear feet	d. linear feet
5. ☐ Bordering Vegetated Wetland	a. square feet	b. square feet	c. square feet	d. square feet
6. ☐ Land Under Waterbodies and Waterways	a. square feet	b. square feet	c. square feet	d. square feet
	e. c/y dredged	f. c/y dredged		
7. ☐ Bordering Land Subject to Flooding	a. square feet	b. square feet	c. square feet	d. square feet
Cubic Feet Flood Storage	e. cubic feet	f. cubic feet	g. cubic feet	h. cubic feet
8. ☐ Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet
9. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

B. Findings (cont.)

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. ☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. ☐ Coastal Beaches	a. square feet	b. square feet	c. cu yd nourishment	d. cu yd nourishment
14. ☐ Coastal Dunes	a. square feet	b. square feet	c. cu yd nourishment	d. cu yd nourishment
15. ☐ Coastal Banks	a. linear feet	b. linear feet		
16. ☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17. ☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. ☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. ☐ Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. ☐ Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	a. c/y dredged	b. c/y dredged		
21. ☐ Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		

B. Findings (cont.)

* **#22.** If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

22. ☐ Restoration/Enhancement *:

a. square feet of BVW | b. square feet of salt marsh

23. ☐ Stream Crossing(s):

a. number of new stream crossings | b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. the work is a maintenance dredging project as provided for in the Act; or
   b. the time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order.
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.
8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.

10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

    "Massachusetts Department of Environmental Protection" [or, "MassDEP"]

    "File Number 212-1125 "

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.

12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.

13. The work shall conform to the plans and special conditions referenced in this order.

14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.

15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.

16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

18. 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 applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

NOTICE OF STORMWATER CONTROL AND MAINTENANCE REQUIREMENTS

19. **The work associated with this Order (the "Project") is** (1) ☑ **is not** (2) ☐ **subject to the Massachusetts Stormwater Standards. If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:**

a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
i. all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
ii. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
iii. any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;
iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;
v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement) for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following: *i.*) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and *ii.*) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):

Special Conditions # 20 thru #40 are attached and must be followed.

20 Prior to the beginning of work, the applicant shall:

a) Obtain approval of the City of Engineer for the design of all drainage structures and facilities.

b) Properly install all siltation controls according to the plans approved by the Conservation Commission.

c) Provide the Conservation Officer with the name and telephone number in writing, of the person who will be immediately responsible for supervision of all work on the project site and compliance with this Order of Conditions. The Conservation Officer shall be notified in the event that the site supervisor or contractor is changed.

d) Clearly mark the limits of work in the field and instruct all workers not to work beyond the limits.

e) Notify Conservation Officer of the date upon which work will commence.

f) Hold a meeting on the project site with the Conservation Officer, the project site supervisor identified in Condition No. 19-C above, and other relevant parties identified by the applicant or the Conservation Commission to review the project and this Order of Conditions. Siltation controls shall be inspected at this time.

g) Failure to comply with Condition Nos. 19A-F, as well as Nos. 8 &9, shall constitute sufficient grounds for the Conservation Commission to order all work to cease until compliance is achieved.

21 The Conservation Officer shall serve as the Commission's agent in all matters pertaining to the interpretation and enforcement of this Order of Conditions. Accepted engineering and construction standards shall be followed in the conduct of all work.

22 Issuance of this Order of Conditions does not in any way imply or certify that the site or downstream areas will not be subject to flooding, storm damage, or any other form of damage due to wetness.

23 All work shall conform to the Notice of Intent, all plans, and all other documents, records, correspondence and representations of the applicant as presented to and approved by Conservation Commission.

24 The applicant shall notify the Commission before performing the modified work. If the Commission deems the modification significant, the applicant shall submit an amended Notice of Intent with any necessary documentation and obtain an amended Order of Conditions. The Commission shall reopen the public hearing in accordance with the provisions of 310 CMR l0.05 (5). The Commission may impose additional or modified conditions to protect the interests of the Wetlands Protection Act.

25 No excavated material shall be disposed of in violation of any local, state, or federal laws. All stumps must be removed from the site; no burying of stumps on site is permitted.

26 Prior to the issuance of a Certificate of Compliance, the applicant shall submit to the Conservation Commission for review and approval an as-built plan and a letter of compliance stamped by a registered professional engineer. Said plan and letter shall show that all conditions of this Order have been complied with in a satisfactory manner.

27 The Conservation Commission shall be notified in writing at the time of any transfer in the title to the property or any change in contractor/developers prior to issuance of the Certificate of Compliance. The name, address, and telephone number of the new owner shall be included in the notification as well as certification that the new owner has been provided with a copy of this Order of Conditions.

28 Prior to the issuance of a Certificate of Compliance the site shall be stabilized with vegetation or other measures approved by the Conservation Commission.

29 Prior to the issuance of a Certificate of Compliance and after the site has been stabilized, all erosion controls shall be removed from the site.

30 If the project involves the disturbance of more than one acre of land area, the applicant is also obligated to submit a Notice of Intent to the EPA for the NPDES Construction Permit per EPA's requirements found at the following web site http://cfpub1.epa.gov/npdes/stormwater/cgp.cfm

SITE-SPECIFIC CONDITIONS
Erosion Control/Construction sequencing

31 Prior to construction the erosion controls as shown on the approved plans shall be installed and inspected during the preconstruction meeting as noted in #20 above.

32 Prior to construction the drainage discharge points shall all be checked to make sure they are clean and clear. If not, they shall be cleaned out to ensure they are working properly before beginning the project.

33 All new catch basins shall be equipped with gas/oil hoods and 4-foot sumps as shown on the plans.

34 The applicant, property owner, and site contractor shall be responsible for regular inspections of the erosion controls on at least a weekly basis and prior to and immediately after (within 12 hours) each storm event. Necessary repairs and maintenance of the erosion control devices shall be made expeditiously. These inspections shall be described in the reports required in the condition below.

35 The applicant/developer shall submit to the Conservation Commission a monthly written status report prepared by a registered professional engineer or environmental consultant competent in such evaluation, during construction summarizing the work that has been completed, compliance of the project with the Order of Conditions, and the status of the erosion controls.

36 The applicant, property owner, and site contractor shall be responsible for notifying the Conservation Commission in an expeditious manner if any visible siltation of wetlands occurs. Immediate measures shall be taken to control the siltation source and to restore any impacted areas.

37 Large piles of soil and other materials shall not be stockpiled closer than 50 feet to any wetland resource area without the approval of the Conservation Officer. Material stockpile areas shall be identified and reviewed at the preconstruction meeting.

38 If during construction dewatering is needed, the dewatering system to be used shall be properly installed and reviewed and inspected by the Conservation Officer. All silty water must be filtered through a dewatering/sedimentation trap system, until such time as the water runs clean. At no point shall silty water be discharged into wetlands or streams without first being filtered.

39 The construction of the various drainage ditches along the side of the roadway shall be coordinated with the weather and shall only be done when there are several days of dry weather. The ditches once constructed must be protected with jute matting or other materials to ensure that the swale won't wash out before vegetation has a chance to establish.

Certificate of Compliance

40 Prior to requesting a Certificate of Compliance, the applicant or its agent shall clean all drainage pipes, drainage swales and catch basins of accumulated sediment and debris so they are working properly.

END CONDITIONS

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☐ Yes ☐ No

2. The _____ hereby finds (check one that applies):
   Conservation Commission

   a. ☐ that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

   _____ _____
   1. Municipal Ordinance or Bylaw 2. Citation

   Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

   b. ☐ that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

   _____ _____
   1. Municipal Ordinance or Bylaw 2. Citation

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.
   The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
212-1125
MassDEP File #

eDEP Transaction #

Marlborough
City/Town

E. Signatures

Simarano Dr. - DPW

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

4/16/2014
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

5
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

Signatures:

✓ Edward Clancy

David Williams

Lawrence Roy

Allan White

John Skarin

Dennis Demers

Michele Higgins

☐ by hand delivery on

Inter office Mail 4/16/2014
Date

☐ by certified mail, return receipt requested, on

Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request of Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Marlborough
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Marlborough
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Simarano Dr.
Project Location

212-1125
MassDEP File Number

Has been recorded at the Registry of Deeds of:

County | Book | Page

for: Property Owner

and has been noted in the chain of title of the affected property in:

Book | Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

Appendix E: Mast Arm Soil Boring Information

April 21, 2014

Mr. Brian Brosnan
Vanasse Hangen Brustlin, Inc.
Union Station, Suite 219
2 Washington Square
Worcester, MA 01604
Phone: (508) 513-2704
Fax: (508) 752-1276
bbrosnan@vhb.com

Re: **Geotechnical Letter Report**
Proposed Mast Arms
Marlborough, Massachusetts
LGCI Project No. 1411

Dear Mr. Brosnan:

Lahlaf Geotechnical Consulting, Inc. (LGCI) has completed five (5) soil borings for the proposed mast arms on Simarano Drive in Marlborough, Massachusetts. This letter report presents the results of our borings. We performed our services in general accordance with the subconsultant agreement for professional services between Vanasse Hangen Brustlin, Inc. (VHB) and Lahlaf Geotechnical Consulting, Inc. (LGCI) dated March 27, 2014 .

1. PROJECT INFORMATION

1.1 Purpose and Scope of Services

The purpose of this study was to obtain subsurface information and to provide recommendations for mast arm foundation design and construction. LGCI performed the following services:

- Staked the boring locations in the field in the presence of a representative of VHB.
- Engaged a drilling subcontractor to advance five (5) borings at the site.
- Provided a geotechnical field engineer, full-time, at the site to coordinate and observe the drilling, describe the soil samples, and prepare field logs.
- Prepared this geotechnical letter report containing the results of our subsurface explorations and our recommendations.

LGCI did not perform environmental services for this project. LGCI did not perform an assessment to evaluate the presence or absence of hazardous or toxic materials above or below the ground surface at or around the site. Any statement about the color, odor, or the presence of suspicious materials included in our boring logs or report were made by LGCI for information only and to support our geotechnical services. No environmental recommendations and/or opinions are included in this report.

Our scope did not include preparing specifications, performing contract document review, or providing construction services. LGCI would be pleased to perform these services, when needed, under a separate agreement. Recommendations for stormwater management, erosion control, pavement design, and detailed cost or quantity estimates are not included in our scope of work.

1.2 Site and Project Description

Our understanding of the existing conditions is based on our field observations and on the following drawing:

- "Marlborough Simarano Drive Traffic Plans," Sheets 46 and 47 of 127, provided to us by VHB on April 7, 2014.

We understand that the City of Marlborough plans improvement at the intersections of Simarano Drive and Forest Street and the intersection of Simarano Drive and Value Way, including the installation of mast arms. We understand that two (2) 25-foot, one (1) 30-foot, and two (2) 35-foot mast arms will be installed at the intersections. Figure 1 shows the locations of the intersections.

The purpose of our services was to explore the subsurface conditions at the proposed mast arm locations, and to submit this letter report containing our boring logs and the soil classification for traffic signal design in accordance with the standard drawing: "Type II Mast Arms Cored Pier Foundations," by the Massachusetts Department of Transportation (MassDOT) and dated February 24, 2011.

2. SITE AND SUBSURFACE CONDITIONS

2.1 Soil Borings

LGCI marked the boring locations in the field in the presence of a representative of VHB, and our drilling subcontractor notified Dig Safe System, Inc. for utility clearance prior to drilling. Our drilling subcontractor also coordinated the drilling with and obtained a street opening permit from the City of Marlborough.

LGCI engaged Soil Exploration Corp. of Leominster, Massachusetts to advance five (5) borings (B-1 to B-5), including four (4) borings at the intersection of Simarano Drive and Forest Street and one (1) boring at the intersection of Simarano Drive and Value Way. The borings were advanced using a track mounted Geoprobe rig on April 10, 2014 and a truck-mounted rig on April 11, 2014. The borings were advanced using 3-inch drive casing and 4 1/4-inch hollow stem augers to depths ranging between 21.1 and 24 feet beneath the ground surface. An LGCI engineer observed and logged the borings in the field.

To explore for shallow utilities, the top 2 feet at borings B-1 and B-4 were excavated using a hand shovel. The drillers performed Standard Penetration Tests (SPT) and obtained split spoon samples with an automatic hammer continuously or at five-foot intervals in general accordance with ASTM D-1586. Upon completion, the boreholes were backfilled with the soil cuttings or with sand. The ground surface in paved areas was restored with asphalt cold patch. Unless notified otherwise, we will dispose of the soil samples after three months.

Figures 2A and 2B show the boring locations and Attachment A includes LGCI's boring logs. Due to utilities or access restraints, the borings were not advanced at the exact locations of proposed mast arms.

2.2 Subsurface Conditions

The subsurface description in this report is based on a limited number of borings and is intended to highlight the major soil strata encountered during our borings. The subsurface conditions are known only at the actual boring locations. Variations may occur and should be expected between boring locations. Boring logs represent conditions that we observed at the time of boring and edited based on the results of the laboratory test data as appropriate. The strata boundaries shown in our boring logs are based on our interpretations and the actual transition may be gradual. Graphic soil symbols are for illustration only.

The soil strata encountered in the borings were as follows, starting at the ground surface:

Asphalt/Topsoil – A layer of 5 to 8 inches of topsoil was encountered at the ground surface in all borings except in boring B-3, advanced in a paved area where a layer of 4 inches of asphalt was encountered at the ground surface.

Fill – Fill was encountered beneath the asphalt or topsoil in the borings and extended to depths of 5.8 to 11.3 feet beneath the ground surface in borings B-1 to B-4, and to a depth 20.2 feet beneath the ground surface at boring B-5. The fill consisted mostly of silty sand and contained traces of organics and traces of roots. The standard penetration test (SPT) N-values ranged in this layer between 9 and 59 blows per foot (bpf), indicating mostly medium dense to dense fill.

Silty Sand – Natural sand was encountered beneath the fill in all borings and extended to the boring termination depth. The sand contained up to 30 percent fines and up to 25 percent gravel. The SPT N-values ranged in this layer between 9 and more than 100 bpf, with most values between 17 and 99, indicating mostly medium dense to very dense sand.

2.3 Groundwater

Groundwater was measured in the borings at the end of drilling at depths ranging between 5 and 17 feet beneath the ground surface at borings B-1 to B-4, and at a depth of 21 feet at boring B-5.

The reported levels may not represent the actual groundwater conditions, as additional time may be required for the groundwater levels to stabilize. The groundwater levels reported herein only represent the conditions encountered at the time and location of our measurements. Seasonal variation should be expected.

3. EVALUATION AND RECOMMENDATIONS

3.1 Mast Arm Foundation Recommendations

3.1.1 General

Based on the results of the borings, the subsurface conditions at the site are suitable to support the proposed mast arm foundations.

The mast arms should be designed in accordance with the standard drawing: "Type II Mast Arms Cored Pier Foundations," by the Massachusetts Department of Transportation (MassDOT) and dated February 24, 2011 (Standard Drawings).

3.1.2 Standard Cored Pier Foundations

The proposed mast arms should be supported on cored pier foundations (drilled shafts). Due to the variable groundwater level in borings B-1 to B-4, the proposed mast arms at the intersection of Forest Street and Simarano Drive should be designed using the Standard Drawings designation "WET SAND." At the intersection of Simarano Drive and Value Way, where the fill was more than 20 feet deep, the mast arm should be designed using the Standard Drawings designation "ALLUVIAL." Due to the steep slope at the latter location, we recommend at a minimum neglecting the lateral resistance of the soil in the top 3 feet.

4. CONSTRUCTION CONSIDERATIONS

4.1 Site Preparation and Earthwork

During construction of the drilled shafts, a temporary casing, that is removed when concrete is placed, will be required to prevent collapse of the fill and sand. When the drilling operations are complete, concrete should be placed inside the casing as soon as possible. The concrete should be placed using a tremie pipe. We recommend pouring the shaft concrete on the same day that

the shaft is drilled. A representative of LGCI should assess that the drilled shaft is founded on competent bearing materials and that the shaft installation procedures comply with our recommendations. The contractor should be prepared to pre-trench to remove boulders in the fill.

5. REPORT LIMITATIONS

Our analysis and recommendations are based on project information provided to us at the time of this report. If changes to the type, size, and location of the proposed structures or to the site grading are made, the recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations modified in writing by LGCI. LGCI cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations and whether our recommendations have been properly implemented in the design.

It is not part of our scope to perform a more detailed site history; therefore, we have not explored for or researched the locations of buried utilities or other structures in the area of the proposed construction. Our scope did not include environmental services or services related to moisture, mold, or other biological contaminates in or around the site.

We cannot accept responsibility for designs based on recommendations in this report unless we are engaged to 1) make site visits during construction to check that the subsurface conditions exposed during construction are in general conformance with our design assumptions and 2) to ascertain that, in general, the work is being performed in compliance with the contract documents.

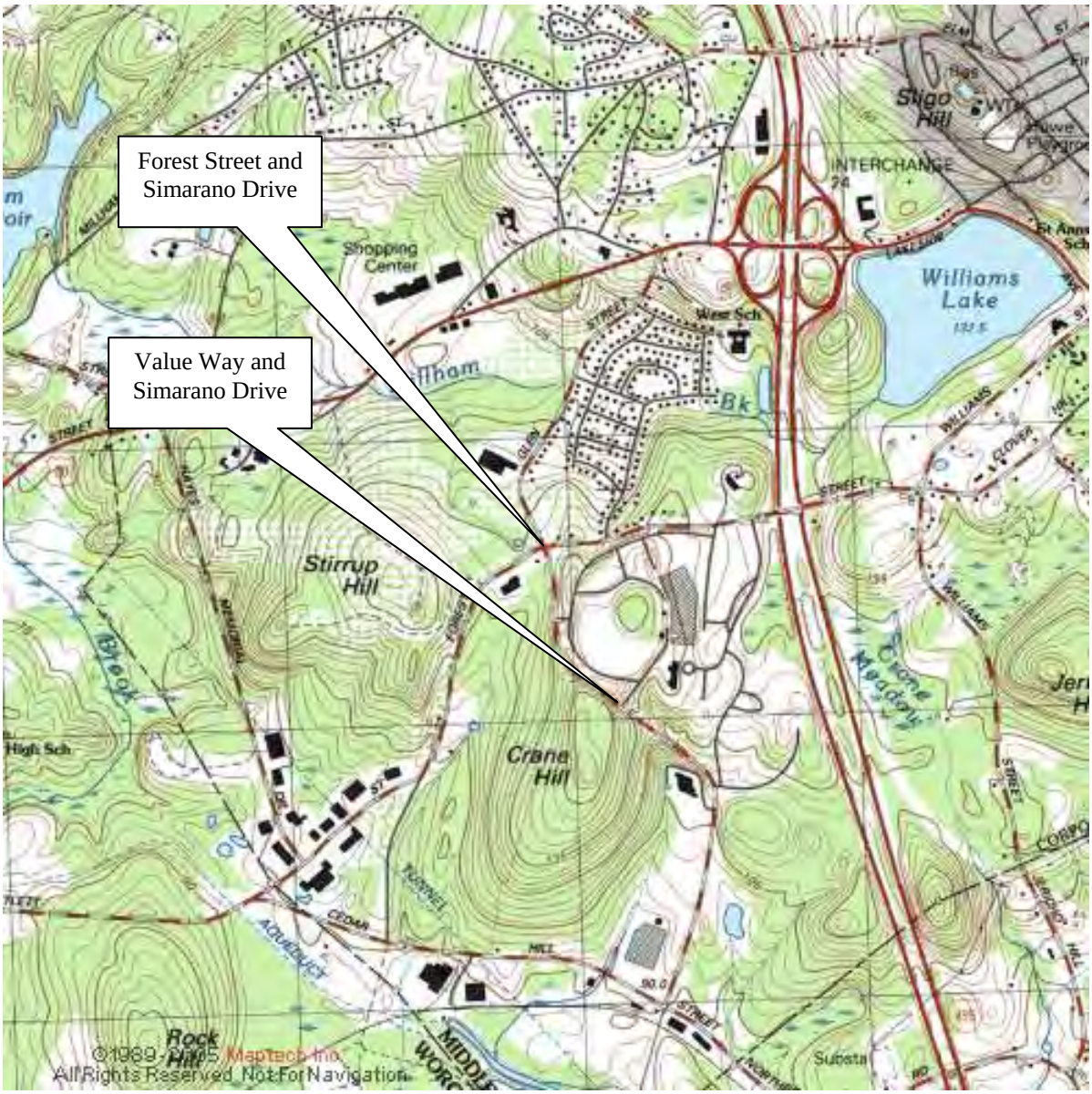
Our report has been prepared in accordance with generally accepted engineering practices and in accordance with the terms and conditions set forth in our agreement. No other warranty, expressed or implied, is made. This report has been prepared for the exclusive use of Vanasse Hangen Brustlin, Inc. for the specific application to the proposed mast arms on Simarano Drive in Marlborough, Massachusetts as conceived at this time.

Very truly yours,

Lahlaf Geotechnical Consulting, Inc.

Abdelmadjid M. Lahlaf, Ph.D., P.E.
Principal Engineer

Attachments: Figure 1 – Site Location Map
Figures 2A and 2B – Boring Location Plan
Attachment A – Boring Logs

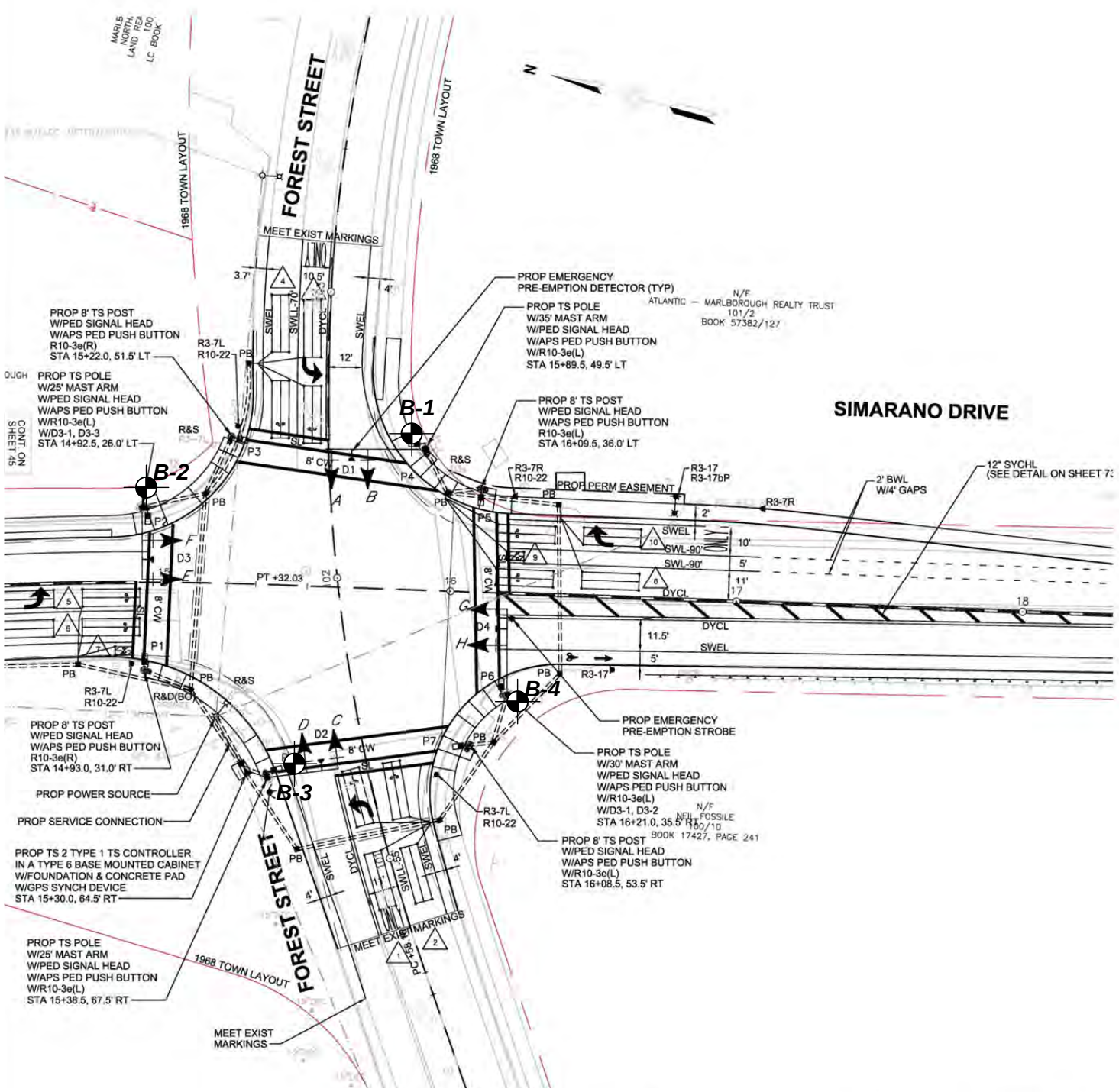


N

Approximate Scale: 1:25000
Contour intervals: 3 meters

Note: Figure based on USGS topographic map of Marlborough, MA – from http://mapserver.mytopo.com

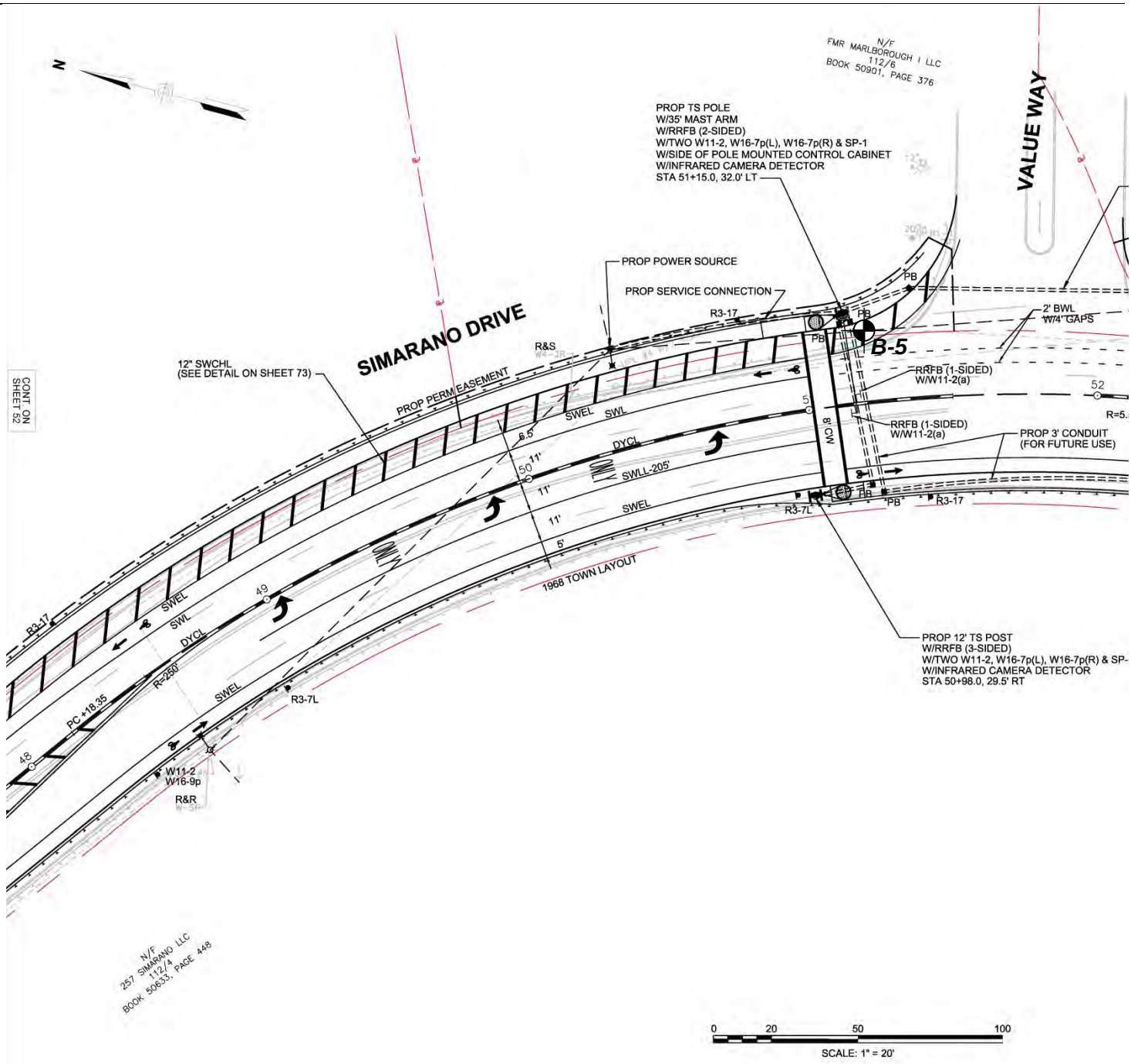
Client:	Project:	**Figure 1 – Site Location Map**	
Vanasse Hangen Brustlin, Inc.	Proposed Mast Arms		
LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Marlborough, MA	LGCI Project No.: 1411	Date: April 2014



Boring drilled by Soil Exploration Corp. of Leominster, Massachusetts, on April 10 and 11, 2014 and observed by Lahlaf Geotechnical Consulting, Inc. (LGCI).

Note: Figure based on drawing titled: "Marlborough Simarano Drive Traffic Plans – Sheet 46 of 127," provided to us by VHB on April 7, 2014.

Client:	Project:	Figure 2A – Boring Location Plan – Forest St. and Simarano Drive	
Vanasse Hangen Brustlin, Inc.	Proposed Mast Arms		
LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Marlborough, MA	LGCI Project No.: 1411	Date: April 2014



Boring drilled by Soil Exploration Corp. of Leominster, Massachusetts, on April 10, 2014 and observed by Lahlaf Geotechnical Consulting, Inc. (LGCI).

Note: Figure based on drawing titled: "Marlborough Simarano Drive Traffic Plans – Sheet 47 of 127," provided to us by VHB on April 7, 2014.

Client:	Project:	Figure 2B – Boring Location Plan – Value Way and Simarano Dr.	
Vanasse Hangen Brustlin, Inc.	Proposed Mast Arms		
LGCI Lahlaf Geotechnical Consulting, Inc.	Project Location: Marlborough, MA	LGCI Project No.: 1411	Date: April 2014

ATTACHMENT A

LGCI Lahlaf Geotechnical Consulting, Inc.

BORING LOG

Boring B-1
Page 1 of 1

Project:	**Proposed Mast Arms, Simarano Drive, Marlborough, Massachusetts**		
Client:	**Vanasse Hangen Brustlin, Inc.**		LGCI Project No.: 1411
Drilling Subcontractor:	Soil Exploration Co.	Date Started:	4/11/2014
Drilling Foreman:	Tim Flores	Date Completed:	4/11/2014
LGCI Engineer:	Geetha Mathiyalakan	Location:	Simarano Drive and Forest Street
Ground Surface El:	NA	Total Depth:	22 feet
Groundwater Depth:	6 feet at the end of drilling (wet samples bet. 5 ft & 7.7 ft)	Drill Rig Type:	Mobil B-57 Truck rig
		Drilling Method:	4 - 1/4" HSA
Hammer Weight:	140 lbs	Split Spoon Diameter:	ID - 1.375", OD - 2"
Hammer Type:	Automatic	Rock Core Barrel Size:	N/A
Drop:	30 inches		

Depth Scale	Sample Depth (ft)	Sample No	Blows per 6 inches 0-6	6-12	12-18	18-24	Pen (in)	Rec (in)	Remarks	Strata	Sample Description
									1	Fill	~5" Topsoil 5" - 2': Silty SAND with Gravel (SM), fine to medium, ~25% fines, 10-15% gravel, traces of organics in the top 12 inches, dark brown to brown, moist (fill)
	2 - 4	S1	6	12	19	14	24	21			S1 - Top 15": Silty SAND with Gravel (SM), fine to medium, 25-30% fines, ~20% mostly coarse angular gravel, traces of organics, black-gray, moist (fill)
5ft											Bot. 6": Silty SAND (SM), fine, ~25% fines, brown, moist (fill)
	5 - 7	S2	24	37	21	25	24	13			S2 - Silty SAND with Gravel (SM), fine to coarse, 15-20% fines, 35-40% mostly coarse angular gravel, gray-brown, wet (fill)
	7 - 9	S3	17	14	21	19	24	17		~7.7'	S3 - Top 8": Silty SAND with Gravel (SM), fine to medium, ~20% fines, ~15% fine gravel, brown, wet (fill)
10ft											Bot. 9": Silty SAND (SM), fine to medium, ~20% slightly plastic fines, 5-10% fine gravel, gray-brown with occasional dark mottles, moist
	10 -12	S4	14	11	17	20	24	13			S4 - Silty SAND (SM), fine to medium, ~5% coarse, ~20% slightly plastic fines, ~10% mostly fine gravel, thin (~2") layer of angular gravel at the tip of the spoon, gray-brown, moist
	12 - 14	S5	29	28	21	27	24	7		Silty Sand	S5 - Poorly Graded GRAVEL with Silt and Sand (GP-GM), mostly fine angular gravel, ~10% fines, ~20% sand, brown-gray, wet
15ft											S6 - Silty SAND with Gravel (SM), fine to coarse, ~15% fines, ~35% mostly fine angular gravel, gray-brown with occasional thin seams of bright brown, wet
	15 - 17	S6	29	20	20	21	24	6			
20ft											S7 - Silty SAND with Gravel (SM), fine to medium, ~10% coarse, 20-25% slightly plastic fines, ~25% fine gravel, dark gray, moist
	20 - 22	S7	22	24	40	37	24	12			
											End of boring at 22 feet. Backfilled with drill cuttings.

Remarks:
1 - Advanced the top 2 feet with hand shovel to clear for the existing utilities.

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BORING LOG

Boring B-2
Page 1 of 1

Project:	**Proposed Mast Arms, Simarano Drive, Marlborough, Massachusetts**		
Client:	**Vanasse Hangen Brustlin, Inc.**		LGCI Project No.: 1411
Drilling Subcontractor:	Soil Exploration Co.	Date Started:	4/11/2014
Drilling Foreman:	Tim Flores	Date Completed:	4/11/2014
LGCI Engineer:	Geetha Mathiyalakan	Location:	Simarano Drive and Forest Street
Ground Surface El:	NA	Total Depth:	21.9 feet
Groundwater Depth:	12 feet at the end of drilling (wet sample bet. 7 ft & 7.6 ft)	Drill Rig Type:	Mobil B-57 Truck rig
		Drilling Method:	4 - 1/4" HSA
Hammer Weight:	140 lbs	Split Spoon Diameter:	ID - 1.375", OD - 2"
Hammer Type:	Automatic	Rock Core Barrel Size:	N/A
Drop:	30 inches		

Depth Scale	Sample Depth (ft)	Sample No	Blows per 6 inches 0-6	6-12	12-18	18-24	Pen (in)	Rec (in)	Remarks	Strata	Sample Description
	0 - 2	S1	4	7	8	10	24	14			S1 - Top 5": Topsoil
											Bot. 9": Silty SAND (SM), mostly fine to medium, ~5% coarse, 25-30% fines, 5-10% mostly coarse gravel, traces of roots, traces of organics, dark brown, moist (fill)
	2 - 4	S2	5	4	5	9	24	4	1	Fill	S2 - Similar to bot. 9" of S1, coarse angular gravel piece at the tip of the spoon, dark brown, moist (fill)
5ft											
	5 - 7	S3	6	4	5	9	24	17		~5.8'	S3 - Top 10": Silty SAND (SM), fine, ~30% fines, occasional thin (~1/16") seams of organics, traces of roots, dark-olive gray, moist (fill)
	7 - 9	S4	9	14	9	19	24	14			Bot. 7": Silty SAND (SM), fine, 25-30% fines, traces of roots, brown-gray with occasional thin (~1/32") seams of bright brown, moist
10ft											S4 - Top 7": Similar to bot. 7" of S3, wet
	10 - 12	S5	6	6	11	15	24	19			Bot. 7": Silty SAND (SM), fine to medium, 5-10% coarse, 20-25% fines, traces of plastic fines, 5-10% fine gravel, brown-gray with occasional thin (~1/16") seams of bright brown, moist
	12 - 14	S6	14	14	12	20	24	20		Silty Sand	S5 - Silty SAND (SM), fine to medium, ~10% coarse, ~25% slightly plastic fines, 5-10% fine gravel, brown-gray with occasional thin (~1/16") seams of bright brown, moist
15ft											S6 - Silty SAND (SM), fine to medium, 10-15% coarse, 20-25% slightly plastic fines, 5-10% fine gravel, dark gray, moist
	15 - 16	S7	21	60	50/0"		12	11			S7 - Silty SAND (SM), fine to medium, 5-10% coarse, 20-25% slightly plastic fines, 5-10% fine gravel, dark gray, moist
									1		S8 - Silty SAND with Gravel (SM), fine to medium, 5-10% coarse, ~20% fines, 20-25% fine to coarse gravel, thin (~1") layer of angular gravel at the tip of the spoon, dark gray, moist
	18 - 19	S8	41	68	50/0"			10			S9 - Silty SAND with Gravel (SM), fine to medium, 5-10% coarse, 15-20% fines, 20-25% fine to coarse gravel, dark gray, moist
20ft											
	20-21.9	S9	40	36	51	100/5"	23	21			End of boring at 21.9 feet. Backfilled with drill cuttings.

Remarks:
1 - Based on drilling action occasional cobbles between 2 ft and 4 ft, and 16.5 ft and 18 ft.

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BORING LOG

Boring B-3
Page 1 of 1

Project:	**Proposed Mast Arms, Simarano Drive, Marlborough, Massachusetts**		
Client:	**Vanasse Hangen Brustlin, Inc.**		LGCI Project No.: 1411
Drilling Subcontractor:	Soil Exploration Co.	Date Started:	4/10/2014
Drilling Foreman:	Don Ledger	Date Completed:	4/10/2014
LGCI Engineer:	A. M. Lahlaf	Location:	Simarano Drive and Forest Street
Ground Surface El:	NA	Total Depth:	21.1 feet
Groundwater Depth:	Between 17' and 20'	Drill Rig Type:	Geoprobe 6610 with SPT
		Drilling Method:	3" casing to 10 feet
Hammer Weight:	140 lbs	Split Spoon Diameter:	ID - 1.375", OD - 2"
Hammer Type:	Automatic	Rock Core Barrel Size:	N/A
Drop:	30 inches		

Depth Scale	Sample Depth (ft)	Sample No	Blows per 6 inches 0-6	6-12	12-18	18-24	Pen (in)	Rec (in)	Remarks	Strata	Sample Description
	0.5-2.5	S1	20	15	13	8	24	14		Asphalt	~ 4" Asphalt S1 - Silty SAND (SM), fine to medium, ~ 30% fines, 5-10% fine gravel, olive gray, moist (fill)
	2.5-4.5	S2	3	7	12	5	24	9			S2 - Top 1": Similar to S1 Bot. 8": Organic soil (buried topsoil)
5ft											
	5 - 7	S3	15	15	8	6	24	12		Fill	S3 - Silty SAND (SM), fine to medium, trace coarse, ~ 25% slightly plastic fines, ~5% fine gravel, olive gray, moist (fill)
	7 - 9	S4	8	7	6	13	24	18		~8.5'	S4 - Similar to S3
10ft											
	10 - 12	S5	21	18	23	33	24	18		Silty Sand	S5 - Silty SAND (SM), fine to medium, trace coarse, ~ 25% slightly plastic fines, ~5% fine gravel, dark gray, moist
	12 - 14	S6	21	23	51	44	24	15			S6 - Silty SAND with Gravel (SM), fine to medium, trace coarse, ~ 20% fines, ~15% fine gravel, desiccated, dark gray, moist
15ft											
	15 - 17	S7	30	33	58	61	24	22			S7 - Similar to S6
20ft											
	20 - 22	S8	44	75	25/1"		13	13			S8 - Similar to S6, ~ 20% fine to coarse gravel
											End of Borings at 21.1 feet. Backfilled with sand and restored the ground surface with asphalt cold patch.

Remarks:

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BORING LOG

Boring B-4
Page 1 of 1

Project:	**Proposed Mast Arms, Simarano Drive, Marlborough, Massachusetts**		
Client:	**Vanasse Hangen Brustlin, Inc.**		LGCI Project No.: 1411
Drilling Subcontractor:	Soil Exploration Co.	Date Started:	4/11/2014
Drilling Foreman:	Tim Flores	Date Completed:	4/11/2014
LGCI Engineer:	Geetha Mathiyalakan	Location:	Simarano Drive and Forest Street
Ground Surface El:	NA	Total Depth:	22.4 feet
Groundwater Depth:	9 feet at the end of drilling (wet sample bet. 10 ft & 11.3 ft)	Drill Rig Type:	Mobil B-57 Truck rig
		Drilling Method:	4 -1/4" HSA
Hammer Weight:	140 lbs	Split Spoon Diameter:	ID - 1.375", OD - 2"
Hammer Type:	Automatic	Rock Core Barrel Size:	N/A
Drop:	30 inches		

Depth Scale	Sample Depth (ft)	Sample No	Blows per 6 inches 0-6	6-12	12-18	18-24	Pen (in)	Rec (in)	Remarks	Strata	Sample Description
									1	Fill	~5" Topsoil 5" - 10": Silty SAND with Gravel (SM), fine to medium, ~25% fines, 15-20% fine angular gravel, traces of organics, dark gray, moist (fill) 10" - 2': Silty SAND with Gravel (SM), fine to medium, ~20% fines, ~15% fine gravel, brown, moist (fill)
	2 - 4	S1	7	9	19	17	24	11			S1 - Top 5": Silty SAND (SM), fine to medium, ~20% fines, 10-15% fine gravel, brown, moist (fill) Bot. 6": Silty SAND with Gravel (SM), fine to medium, ~5% coarse, 25% fines, thin (~2") layer of fine angular gravel, olive gray, most (fill)
5ft	4 - 6	S2	21	9	8	11	24	14			S2 - Silty SAND (SM), mostly fine, 30-35% fines, occasional thin (~1/4") seams of organics, few wood fibers in the middle of the sample, dark brown-olive gray, moist (fill)
	6 - 8	S3	26	17	16	12	24	11			S3 - Silty SAND (SM), fine to medium, ~5% coarse, ~25% fines, traces of plastic fines, olive gray, moist (fill)
	8 - 10	S4	9	9	7	9	24	16			S4 - Silty SAND (SM), fine to medium, ~30% slightly plastic fines, ~5% fine gravel, brown-olive gray, moist (fill)
10ft										~11.3'	S5 - Top 15": Similar to S4, wet (fill)
	10 - 12	S5	7	14	22	16	24	22			Bot. 7": Silty SAND (SM), fine to medium, ~5% coarse, 25-30% slightly plastic fines, ~5% fine gravel, brown-gray, moist
	12 - 14	S6	16	20	23	31	24	9			S6 - Similar to S5, <5% fine gravel, desiccated, brown-gray, moist
15ft										Silty Sand	Simarano Drive and Forest Street
	15 - 17	S7	36	44	51	39	24	16			S7 - Silty SAND with Gravel (SM), fine to medium, ~5% coarse, 20-25% slightly plastic fines, ~15% fine gravel, brown-gray, moist
20ft											S8 - Silty SAND (SM), fine to medium, ~5% coarse, 25-30% slightly plastic fines, ~5% fine gravel, dark gray, moist
	20 - 22	S8	21	23	28	25	24	19			S9 - Similar to S8, fine angular gravel piece at the tip of the spoon, dark gray, moist
	22-22.4	S9	100/5"				5	2			End of boring at 22.4 feet. Backfilled with drill cuttings.

Remarks:
1 - Advanced the top 2 feet with hand shovel to clear for the existing utilities.

LGCI
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BORING LOG

Boring B-5
Page 1 of 1

Project:	**Proposed Mast Arms, Simarano Drive, Marlborough, Massachusetts**		
Client:	**Vanasse Hangen Brustlin, Inc.**		LGCI Project No.: 1411
Drilling Subcontractor:	Soil Exploration Co.	Date Started:	4/10/2014
Drilling Foreman:	Don Ledger	Date Completed:	4/10/2014
LGCI Engineer:	A. M. Lahlaf	Location:	Simarano Drive and Value Way
Ground Surface El:	NA	Total Depth:	24 feet
Groundwater Depth:	21 feet	Drill Rig Type:	Geoprobe 6610 with SPT
		Drilling Method:	3" casing to 10 feet
Hammer Weight:	140 lbs	Split Spoon Diameter:	ID - 1.375", OD - 2"
Hammer Type:	Automatic	Rock Core Barrel Size:	N/A
Drop:	30 inches		

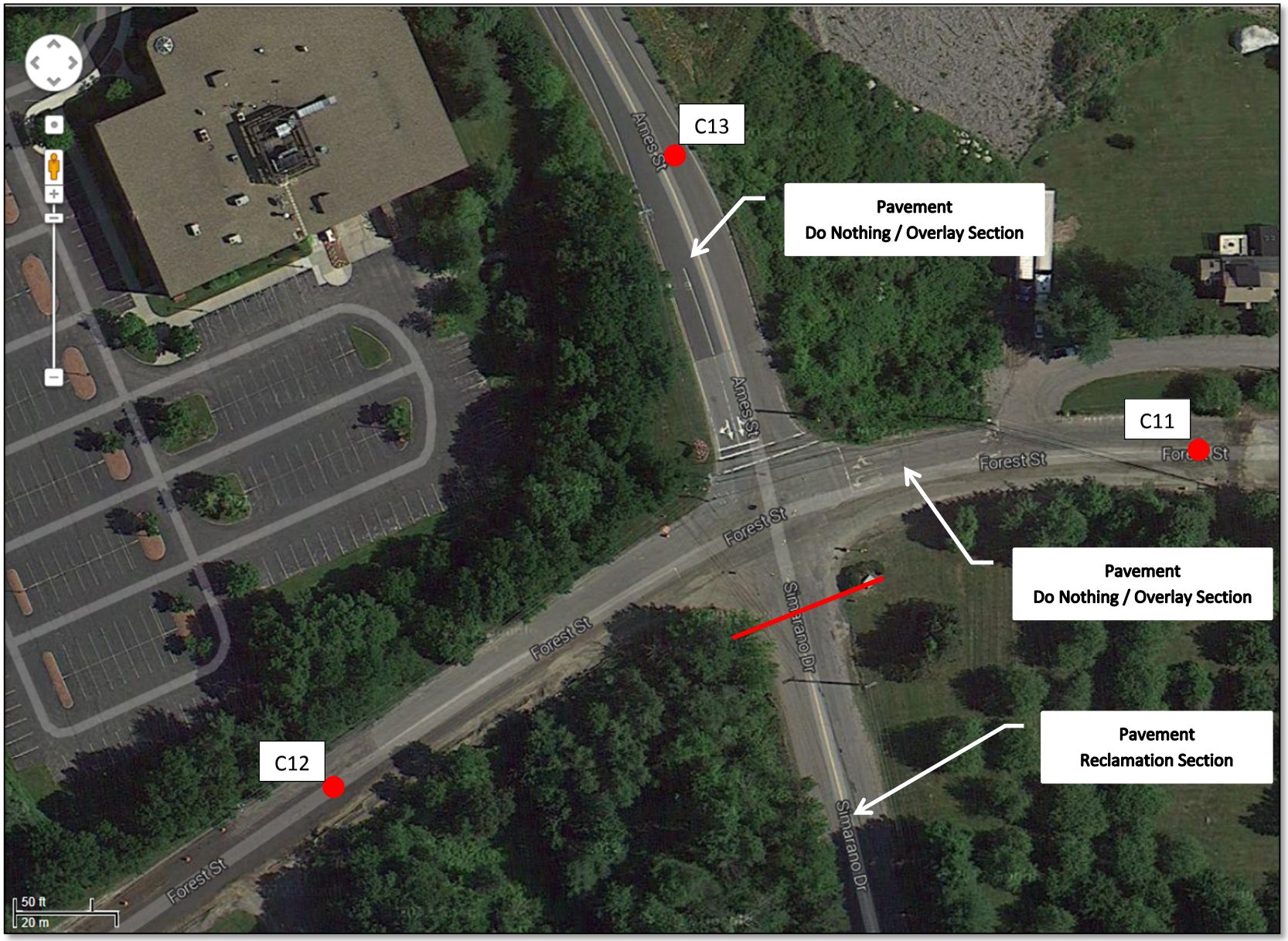
Depth Scale	Sample Depth (ft)	Sample No	Blows per 6 inches 0-6	6-12	12-18	18-24	Pen (in)	Rec (in)	Remarks	Strata	Sample Description
	0 - 2	S1	1	1	2	3	24	8			S1 - Topsoil
	2 - 4	S2	3	4	2	3	23	13			S2 - Silty SAND (SM), fine to medium, ~ 30% slightly plastic fines, traces of organics, gray, moist (fill)
5ft	5 - 7	S3	8	20	39	16	24	12			S3 - Silty SAND with Gravel (SM), fine to medium, ~ 30% slightly plastic fines, ~ 15% fine gravel, olive gray, moist (fill)
10ft	10 - 12	S4	20	14	18	14	24	18			S4 - Similar to S3 - traces of roots (fill)
	12 - 14	S5	10	8	16	22	24	16			S5 - Similar to S3 - traces of roots, no gravel, bottom 4" wet (fill)
15ft	14 - 16	S6	63	22	11	13	24	18			S6 - Similar to S3 - ~ 25% gravel, moist (fill)
	18 - 20	S7	20	22	24	39	24	22			S7 - Silty SAND (SM), fine to medium, ~ 30% slightly plastic fines, 10-15% fine gravel, traces of roots, olive gray, moist (fill)
20ft	20- 22	S8	33	53	59	51	24	18		Fill ~20.2'	S8 - Well Graded SAND with Silt and Gravel (SW-SM), fine to coarse, 10-15% fines, ~ 25% fine gravel, orange brown, bot. 6" wet (top 2" similar to S7-fill)
	22-24	S9	30	51	48	40	24	8		Silty Sand	S9 - Similar to S8 - No fill
											End of boring at 24 feet. Backfilled with sand.

Remarks:

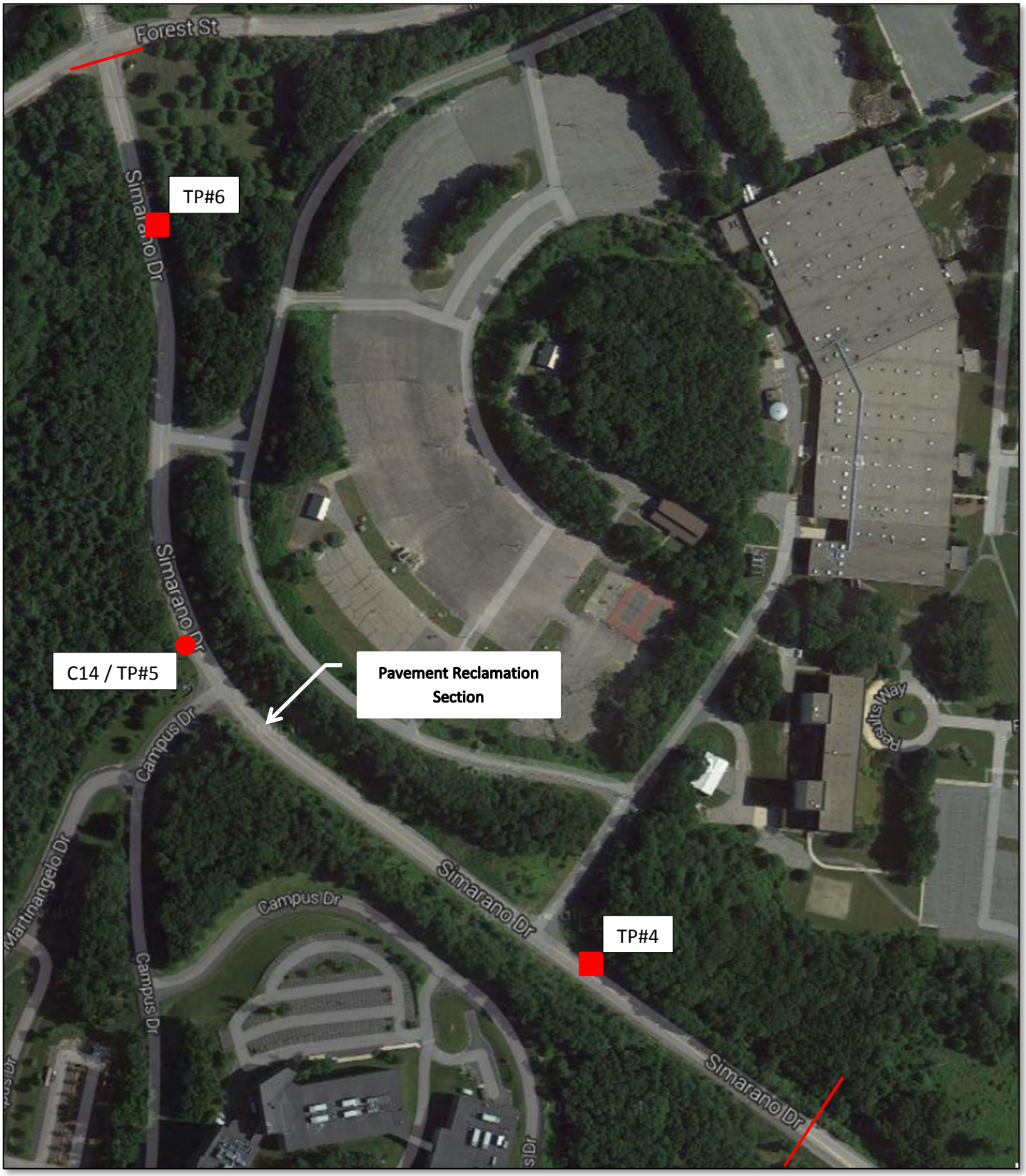
Appendix F: Pavement Test Pit & Pavement Core Reports

PAVEMENT SAMPLING PLAN

Simarano Drive / Forest Street / Ames Street Intersection

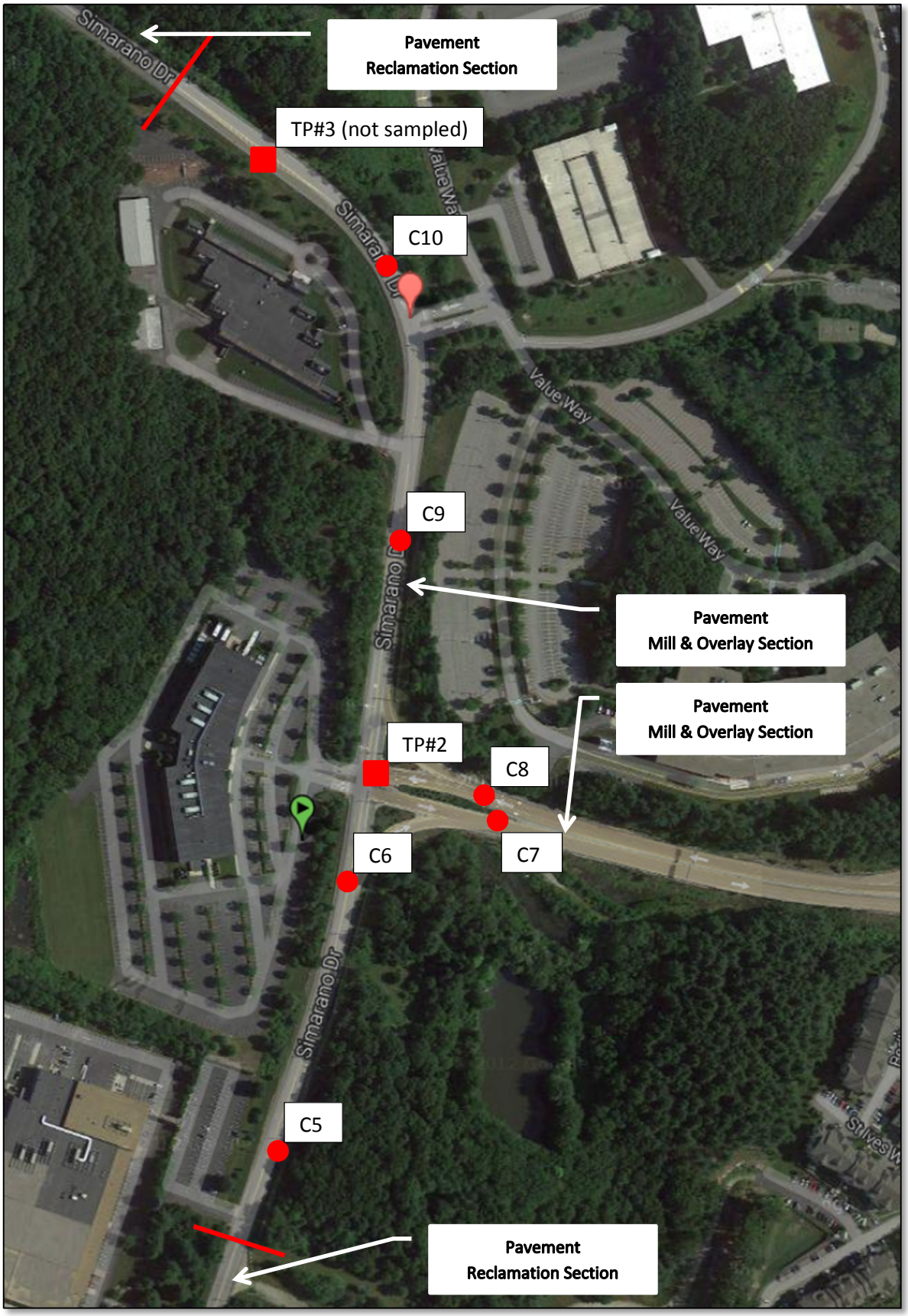


PAVEMENT SAMPLING PLAN
Simarano Drive (Reclamation Section)



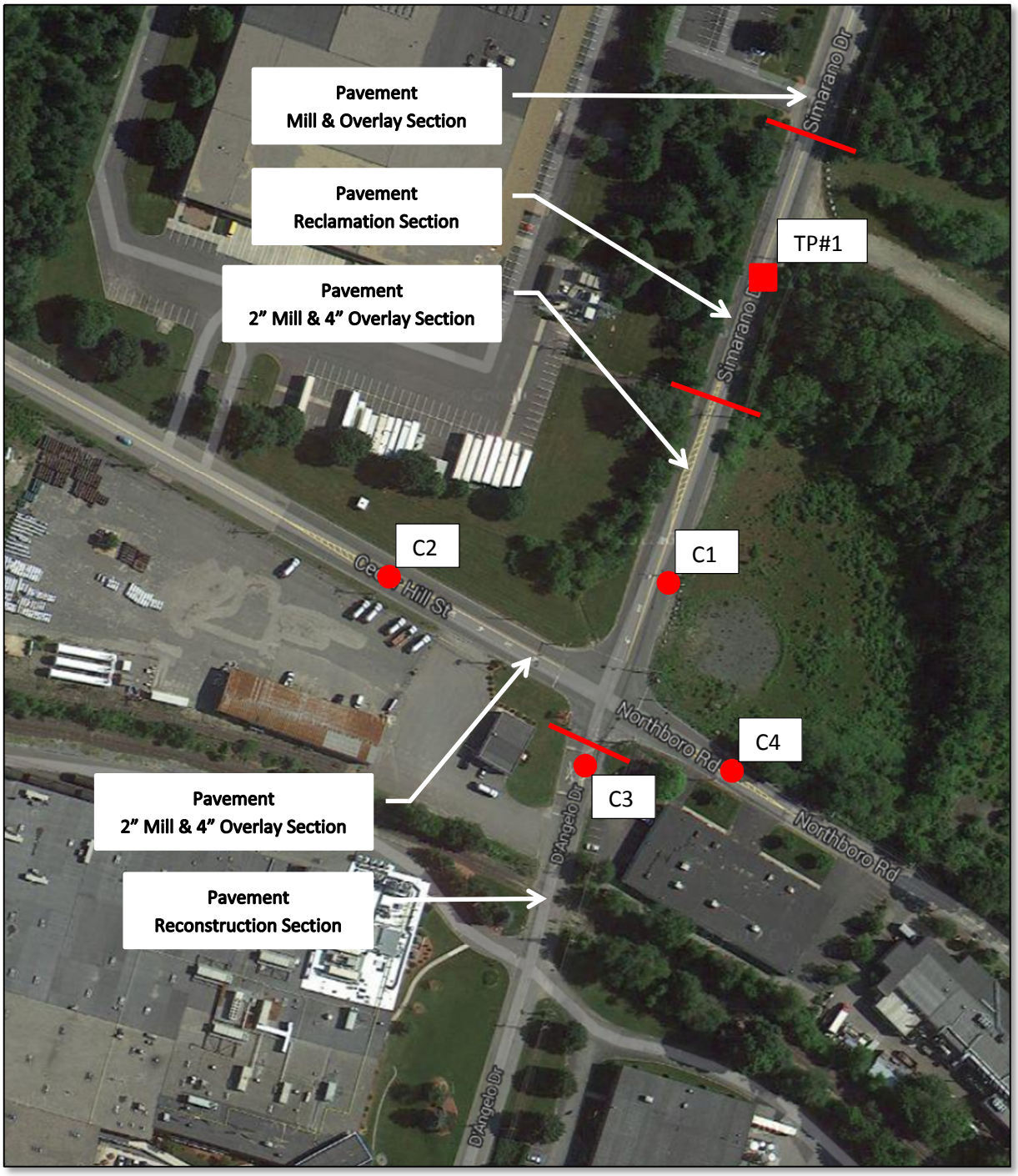
PAVEMENT SAMPLING PLAN

Simarano Drive & Route 495 (Mill & Overlay Section)



PAVEMENT SAMPLING PLAN

Simarano Drive / DeAngelo Drive / Cedar Hill Street Intersection



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Vanasse Hangen Brustlin, Inc.

LOCATION: Marlborough, MA
DATE SAMPLED: 8/14/2013

STREETS: Simarano Dr, DeAngelo Dr
Cedar Hill Road Intersection

CORE#: 1 **Area:** *Simarano Drive* *190' N of Cedar Hill Rd., 7' off the NB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
44	1.750	Surface Course	Good
31	1.250	Binder Course	Good
91	3.63	Base Course	
Total:	6.625	Gravel	

CORE#: 2 **Area:** *Cedar Hill Rd (W)* *150' W of Simarano Dr., 12' off the WB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
44	1.75	Surface Course	Good
31	1.25	Binder Course	Good
47	1.875	Binder Course	
Total:	4.875	Sand with Gravel	

CORE#: 3 **Area:** *DeAngelo Drive* *85' S of Cedar Hill Rd., 18' off the NB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
59	2.38	Surface Course	
Total:	2.38	Silty Sand with Gravel	

CORE#: 4 **Area:** *Cedar Hill Rd (E)* *135' E of Cedar Hill Rd., 13' off the EB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
47	1.88	Surface Course	Good
41	1.63	Binder	Good
38	1.50	Binder	
Total:	5.00	Processed Gravel	

	Average	Minimum	Maximum
Surface Course Thickness:	1.938	1.750	2.375
Binder Course/Base Thickness:	3.710	3.125	4.880
Overall Thickness:	4.72	3.13	4.88

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Vanasse Hangen Brustlin, Inc.

LOCATION: Marlborough, MA
DATE SAMPLED: 8/14/2013
STREET: Simarano Drive
SECTION NAME: Rt. 495 Ramp Rehab. Area

CORE#: 5 **Area:** *Simarano Drive* *85' N of #445 Simarano Dr., 20' off the NB EOP*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
63	2.50	Surface Course	Good
69	2.75	Binder Course	Poor
138	5.50	Binder Course	
Total:	10.750	Reclaim Gravel	

CORE#: 6 **Area:** *Simarano Drive* *225' S of Rt. 495 Ramps, 18' off the SB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
34	1.38	Surface Course	Good
153	6.13	Binder Course	Poor
188mm +	7.5" +	Binder/Base Course	
Total:	15" +	*not available (core bit depth maxed out)*	

CORE#: 9 **Area:** *Simarano Drive* *165' N of #257 Simarano Dr., 23' off the NB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
53	2.13	Surface Course	Good
53	2.13	Binder Course	Good
97	3.88	Base Course	
Total:	8.13	Dense Graded Crushed Stone	

CORE#: 10 **Area:** *Simarano Drive* *105' N of Value Way, 8' off the NB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
38	1.50	Surface Course	Good
56	2.25	Binder Course	Poor
94	3.75	Binder Course	
Total:	7.50	Dense Graded Crushed Stone	

	Average	Minimum	Maximum
Surface Course Thickness:	1.875	1.375	2.500
Binder Course/Base Thickness:	8.469	6.000	13.625
Overall Thickness:	10.34	7.50	15"+

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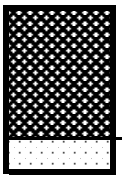
Vanasse Hangen Brustlin, Inc.

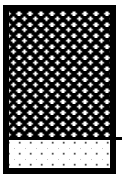
LOCATION: Marlborough, MA
DATE SAMPLED: 8/14/2013
STREET: Route 495 Ramps
SECTION NAME: Rt 495 Ramp Rehab. Area

CORE#: 7 **Area:** *Rt 495 On Ramp* *210' E of Simarano Dr., 13' off the median curb*



DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
50	2.00	Surface Course	Good
63	2.50	Binder Course	Good
103	4.125	Base Course	
Total:	8.625	Dense Graded Crushed Stone	

CORE#: 8 **Area:** *Rt 495 Off Ramp* *260' E of Simarano Dr., 21' off the median curb*



DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
50	2.00	Surface Course	Good
66	2.625	Binder Course	Good
116	4.625	Base Course	
Total:	9.25	Dense Graded Crushed Stone	

	Average	Minimum	Maximum
Surface Course Thickness:	2.00	2.00	2.00
Binder/Base Course Thickness:	6.688	6.625	6.75
Overall Thickness:	8.94	8.625	9.25

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Vanasse Hangen Brustlin, Inc.

LOCATION: Marlborough, MA
DATE SAMPLED: 8/14/2013
STREET NAME: Simarano Drive
SECTION NAME: Reconstruction Section

CORE#: ***14 / TP #5*** **Area:** *Simarano Drive* *228' S of Campus Dr., 6' off the SB EOP*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
44	1.75	Surface Course	Good
75	3.00	Base Course	
Total:	4.75	Sand with Gravel	

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Vanasse Hangen Brustlin, Inc.

LOCATION: Marlborough, MA STREET: Forest Street
DATE SAMPLED: 8/14/2013

CORE#: 11 **Area:** *Forest Street* *280' E of Simarano Dr., 20' off the EB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
47	1.875	Surface Course	Good
31	1.25	Binder Course	Good
72	2.875	Base Course	
Total:	6.00	Reclaim Gravel	

CORE#: 12 **Area:** *Forest Street* *335' W of Simarano Dr., 20' off the WB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
63	2.50	Surface Course	Good
31	1.25	Binder Course	Good
75	3.00	Base Course	
Total:	6.75	Reclaim Gravel	

	Average	Minimum	Maximum
Surface Course Thickness:	2.188	1.875	2.50
Binder/Base CourseThickness:	4.188	4.125	4.25
Overall Thickness:	6.375	6.00	6.75

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Vanasse Hangen Brustlin, Inc.

LOCATION: Marlborough, MA Street Name: Ames Street
DATE SAMPLED: 8/14/2013

CORE#: 13 **Area:** *Ames Street* *260' N. of Forest St., 13' off the NB curb*

DEPTH mm	DEPTH inches	CLASSIFICATION	BOND
41	1.625	Surface Course	Good
59	2.375	Binder Course	Good
50	2.00	Base Course	
Total:	6.00	Reclaim Gravel	

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Middletown, Connecticut 06457-1847
860.632.1500 ▪ FAX 860.632.7879
email: info@vhb.com
www.vhb.com

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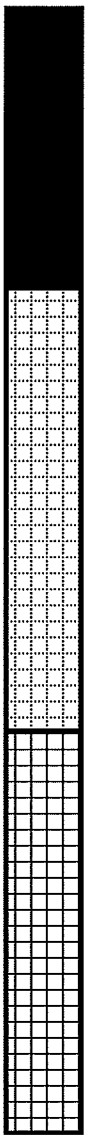
54 Tuttle Place
Middletown Connecticut 06457
860.632.1500
FAX 860.632.7879

VHB Vanasse Hangen Brustlin, Inc.

STREET: Simarano Drive
CITY, STATE: Marlborough, MA

PROJECT #: 12247.01

TP# / LOCATION: TP 1 - 460' N of Cedar Hill St., 11' off the NB Curb, (Utility Pole #3)



7" Hot Mix Asphalt (HMA) (0.5" Surface (deteriorated & poor bond) / 6.5" Binder (heavy stripping))

11" poorly graded gravel with sand A-1-a

[Gravel Borrow, Type A]
3.3% P200

10" silty gravel with sand
A-2-4(0)

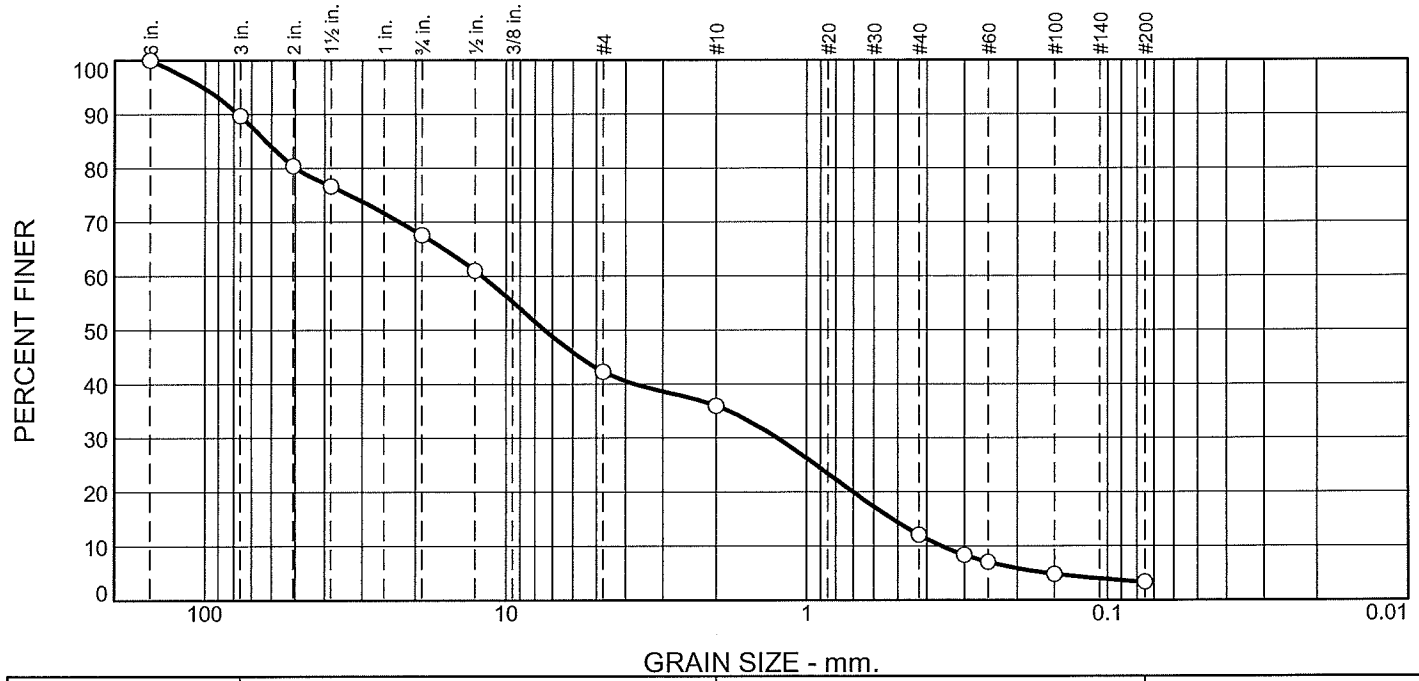
27% P200

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 1 - 460' N of Cedar Hill St., 11' off the NB Curb, (Utility Pole #3)
Sample Number: BASE **Depth:** 11 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
10	54	24	9	3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	90	100	X
2"	80		
1-1/2"	77		
3/4"	68		
1/2"	61	50 - 85	
#4	42	40 - 75	
#10	36		
#40	12		
#50	8	8 - 28	
#60	7		
#100	5		
#200	3.3	0.0 - 10	

* MA - M1.03.0 Gravel Borrow "B"

Material Description

poorly graded gravel with sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 62.6321 D_{60}= 12.0289 D_{50}= 7.4241
D_{30}= 1.2524 D_{15}= 0.5205 D_{10}= 0.3582
C_u= 33.58 C_c= 0.36

Classification

USCS= GP AASHTO= A-1-a

Remarks

Figure

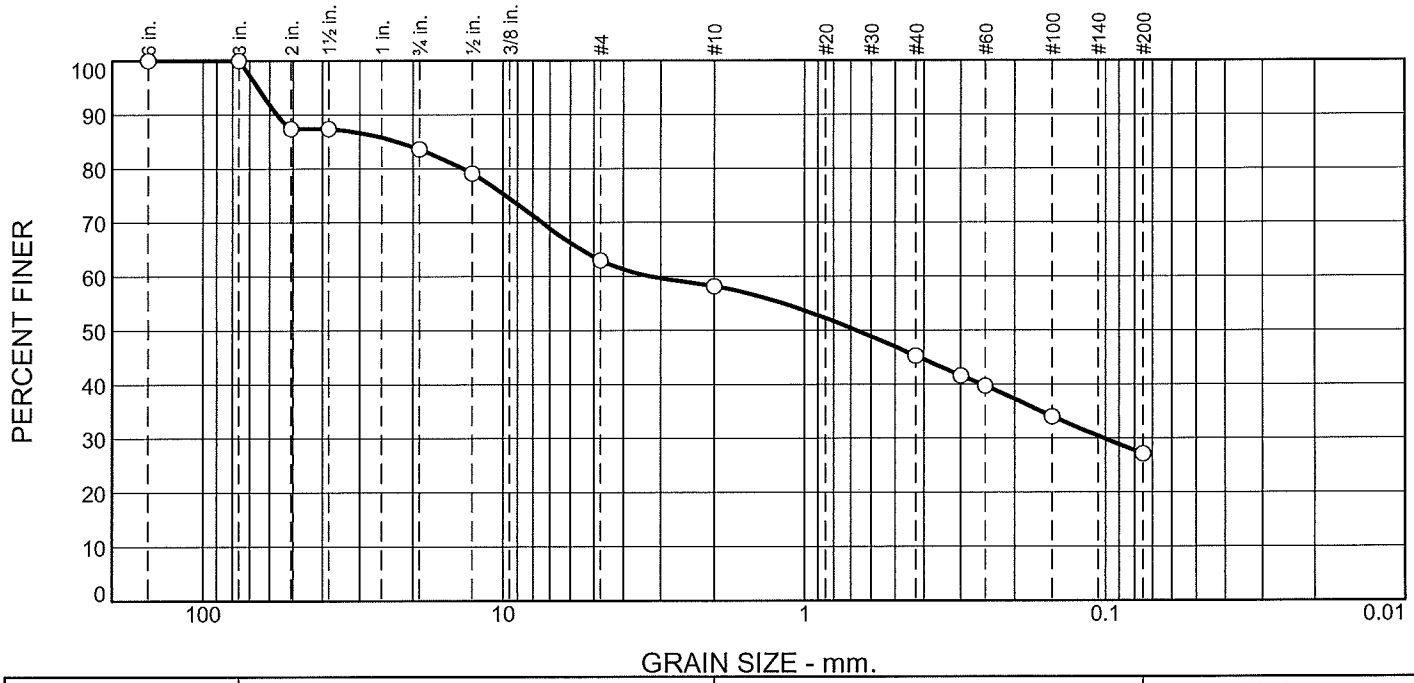
Tested By: JSG/BS **Checked By:** VHB

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 1 - 460' N of Cedar Hill St., 11' off the NB Curb, (Utility Pole #3)
Sample Number: SUBBASE **Depth:** 10 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
0	42	13	18	27

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	100	100	
2"	87		
1-1/2"	87		
3/4"	84		
1/2"	79	50 - 85	
#4	63	40 - 75	
#10	58		
#40	45		
#50	42	8 - 28	X
#60	40		
#100	34		
#200	27	0.0 - 10	X

* MA - M1.03.0 Gravel Borrow "B"

Material Description

silty gravel with sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 22.6472 D_{60}= 3.2294 D_{50}= 0.6713
D_{30}= 0.1014 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= GM AASHTO= A-2-4(0)

Remarks

Heavy Fill Section 20' +

Figure

Tested By: JSG/BS **Checked By:** VHB

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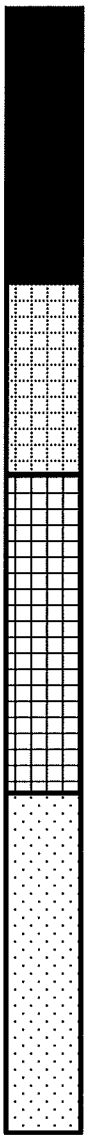
54 Tuttle Place
Middletown Connecticut 06457
860.632.1500
FAX 860.632.7879

VHB *Vanasse Hangen Brustlin, Inc.*

STREET: Simarano Drive
CITY, STATE: Marlborough, MA

PROJECT #: 12247.01

TP# / LOCATION: TP 2 - 1725' N of Cedar Hill St., 8' off the NB Curb, (Utility Pole # 10)



6.5" Hot Mix Asphalt
(HMA) (1.25" Surface
(fair bond) / 2.25" Binder
(poor bond) / 3" Base
(part. deteriorated))

4.5" M2.01.7 Dense
Graded Crushed Stone A-
1-a
[Dense Graded Crushed Stone]
7.2% P200

7.5" M1.03.0 Gravel
Borrow "B" A-1-a
[Gravel Borrow, Type B]
4.9% P200

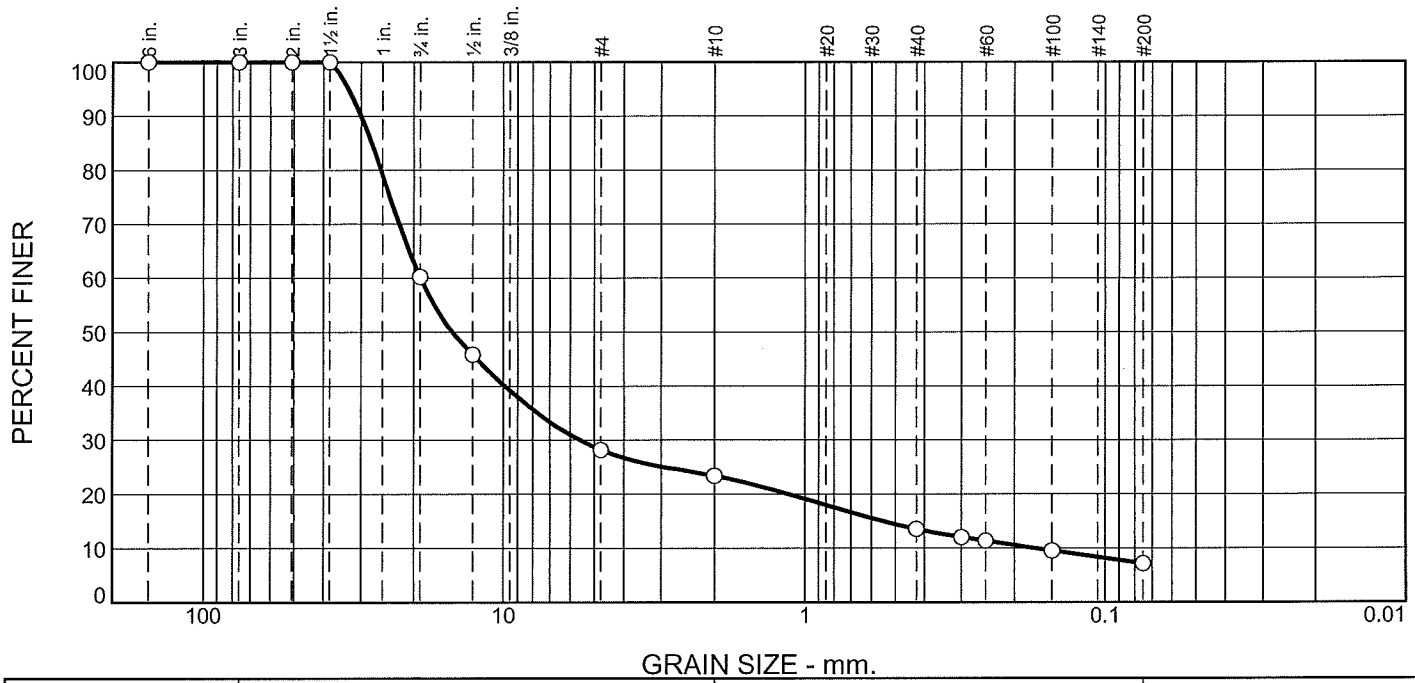
8" M1.03.0 Gravel Borrow
"B" A-1-b
[Gravel Borrow, Type B]
6.5% P200

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 2 - 1725' N of Cedar Hill St., 8' off the NB Curb, (Utility Pole # 10)
Sample Number: BASE **Depth:** 4.5 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
0	77	9	7	7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	100		
2"	100	100	
1-1/2"	100	70 - 100	
3/4"	60	50 - 85	
1/2"	46		
#4	28	30 - 55	X
#10	23		
#40	14		
#50	12	8 - 24	
#60	11		
#100	10		
#200	7.2	3.0 - 10	

* MA - M2.01.7 Dense Graded

Material Description

poorly graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 27.7182 D_{60}= 18.9653 D_{50}= 14.8037
D_{30}= 5.5697 D_{15}= 0.5486 D_{10}= 0.1715
C_u= 110.58 C_c= 9.54

Classification

USCS= GP-GM AASHTO= A-1-a

Remarks

Figure

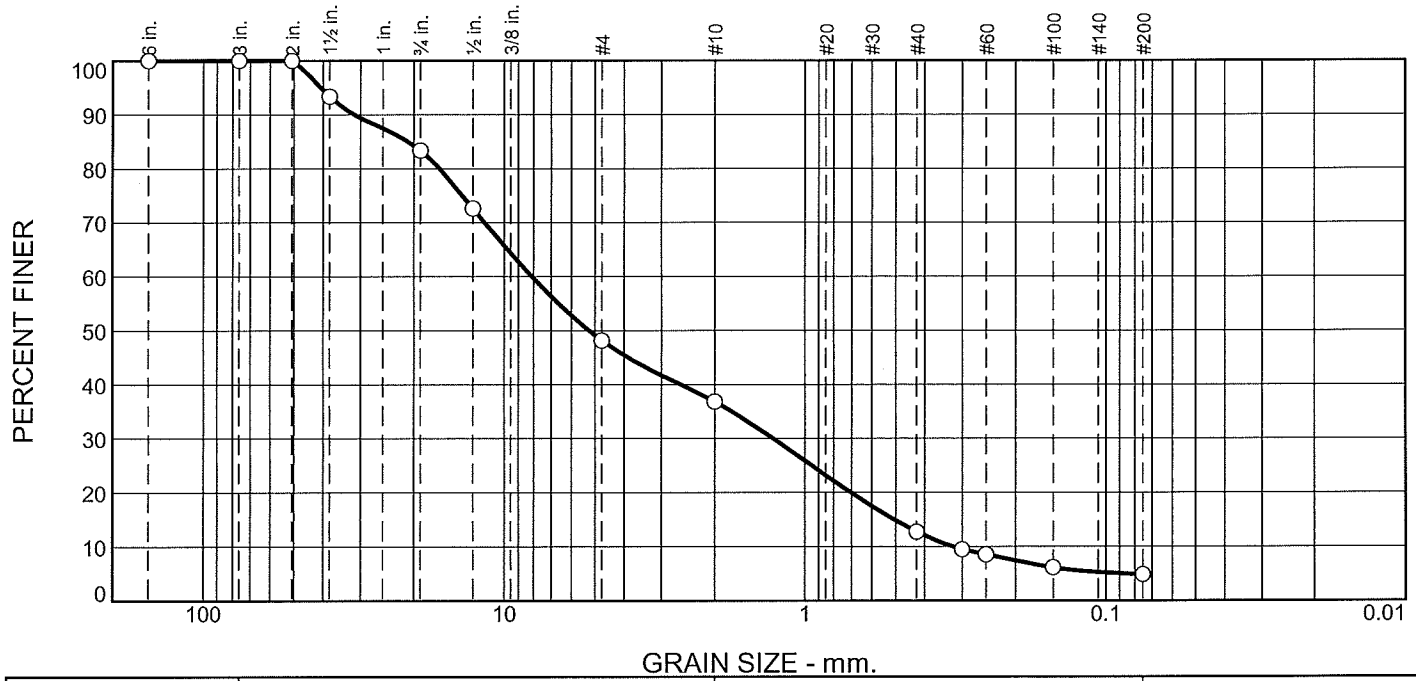
Tested By: JSG/BS **Checked By:** VHB

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 2 - 1725' N of Cedar Hill St., 8' off the NB Curb, (Utility Pole # 10)
Sample Number: SUBBASE **Depth:** 7.5 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
0	63	24	8	5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	100	100	
2"	100		
1-1/2"	93		
3/4"	83		
1/2"	73	50 - 85	
#4	48	40 - 75	
#10	37		
#40	13		
#50	9	8 - 28	
#60	9		
#100	6		
#200	4.9	0.0 - 10	

* MA - M1.03.0 Gravel Borrow "B"

Material Description

poorly graded gravel with sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 20.9279 D_{60}= 8.0998 D_{50}= 5.2403
D_{30}= 1.2748 D_{15}= 0.5057 D_{10}= 0.3224
C_u= 25.12 C_c= 0.62

Classification

USCS= GP AASHTO= A-1-a

Remarks

Figure

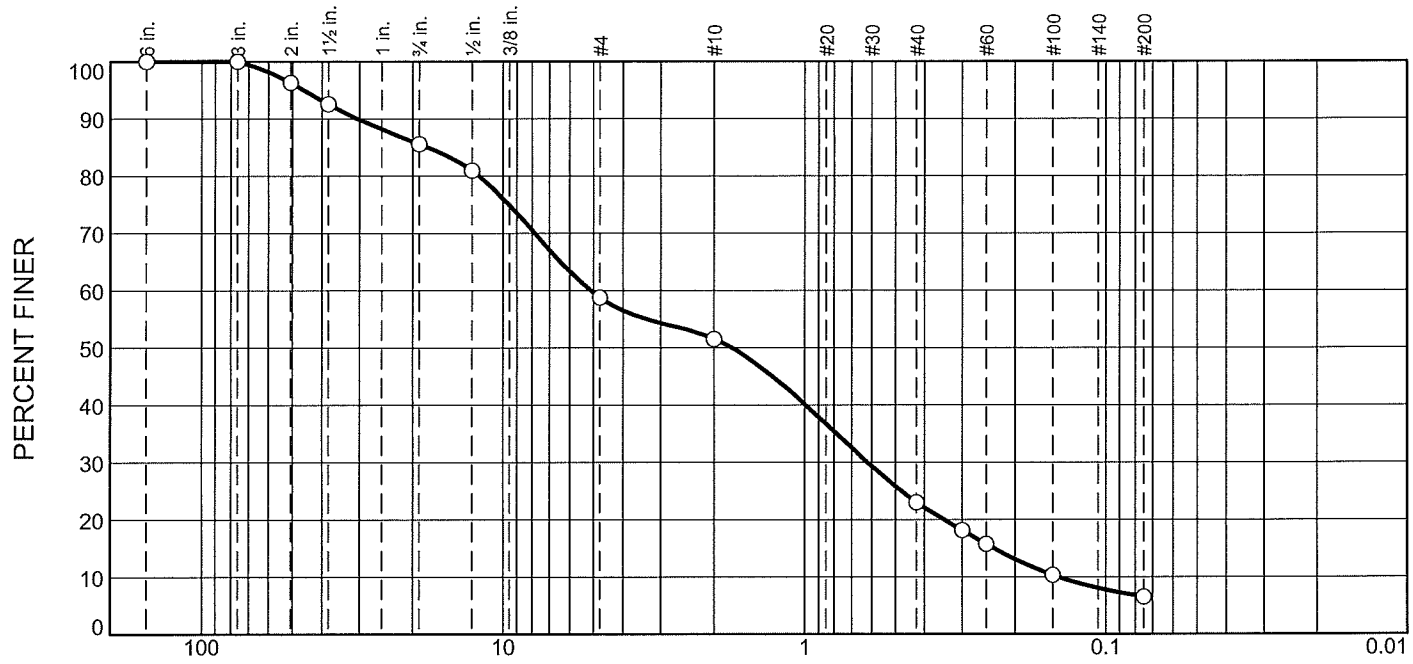
Tested By: JSG/BS **Checked By:** VHB

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 2 - 1725' N of Cedar Hill St., 8' off the NB Curb, (Utility Pole # 10)
Sample Number: SUBBASE 2 **Depth:** 8 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
0	48	29	17	6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	100	100	
2"	96		
1-1/2"	93		
3/4"	86		
1/2"	81	50 - 85	
#4	59	40 - 75	
#10	52		
#40	23		
#50	18	8 - 28	
#60	16		
#100	10		
#200	6.5	0.0 - 10	

* MA - M1.03.0 Gravel Borrow "B"

Material Description

poorly graded sand with silt and gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 17.8210 D_{60}= 5.1086 D_{50}= 1.7532
D_{30}= 0.6203 D_{15}= 0.2355 D_{10}= 0.1445
C_u= 35.36 C_c= 0.52

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Refusal at 26" due to large rocks

Figure

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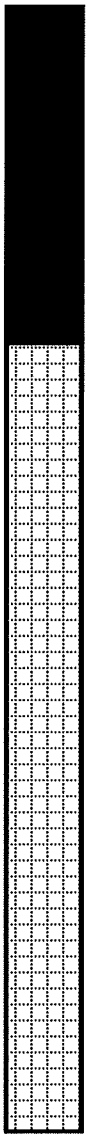
54 Tuttle Place
Middletown Connecticut 06457
860.632.1500
FAX 860.632.7879

VHB *Vanasse Hangen Brustlin, Inc.*

STREET: Simarano Drive
CITY, STATE: Marlborough, MA

PROJECT #: 12247.01

TP# / LOCATION: TP 4 - 3927' N of Cedar Hill St., 10' off the NB Edge of Pavement, (Utility Pole # 36)



6" Hot Mix Asphalt (HMA)
(1.25" Surface / 1.5"
Binder (poor bond) /
3.25" Base (heavy
stripping))

14" poorly graded gravel
with silt and sand A-1-a

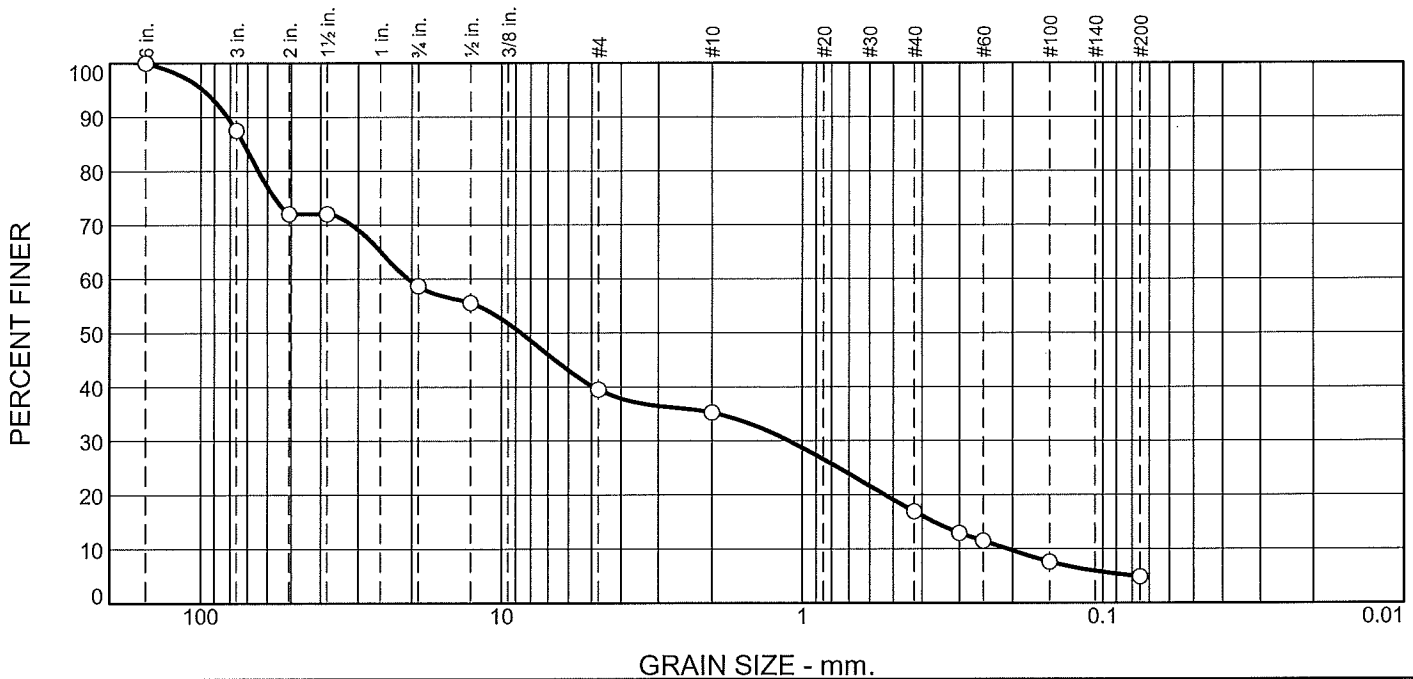
[Gravel Borrow, Type A]
4.8% P200

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 4 - 3927' N of Cedar Hill St., 10' off the NB Edge of Pavement, (Utility Pole # 36)
Sample Number: BASE **Depth:** 14 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
12	53	18	12	5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	88	100	X
2"	72		
1-1/2"	72		
3/4"	59		
1/2"	56	50 - 85	
#4	39	40 - 75	X
#10	35		
#40	17		
#50	13	8 - 28	
#60	11		
#100	8		
#200	4.8	0.0 - 10	

* MA - M1.03.0 Gravel Borrow "B"

Material Description

poorly graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 71.7926 D_{60}= 20.5145 D_{50}= 8.6182
D_{30}= 1.1072 D_{15}= 0.3653 D_{10}= 0.2078
C_u= 98.72 C_c= 0.29

Classification

USCS= GP-GM AASHTO= A-1-a

Remarks

Hill cut Area

Figure

Tested By: JSG/BS **Checked By:** VHB

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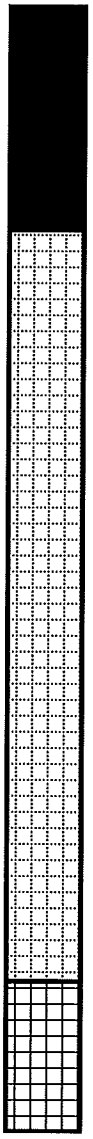
Middletown Connecticut 06457
860.632.1500
FAX 860.632.7879

VHB *Vanasse Hangen Brustlin, Inc.*

STREET: Simarano Drive
CITY, STATE: Marlborough, MA

PROJECT #: 12247.01

TP# / LOCATION: TP 6 - 5742' N of Cedar Hill St., 13' off the NB Edge of Pavement, (Utility Pole # 21)



6" Hot Mix Aspalt (HMA)
(1.5" Surface / 1.5" Binder
(poor bond) / 3" Base)

20" poorly graded sand
with silt and gravel A-1-a

[Gravel Borrow, Type A]
4.6% P200

4" silty sand A-4(0)

Frost Potential: moderate to high

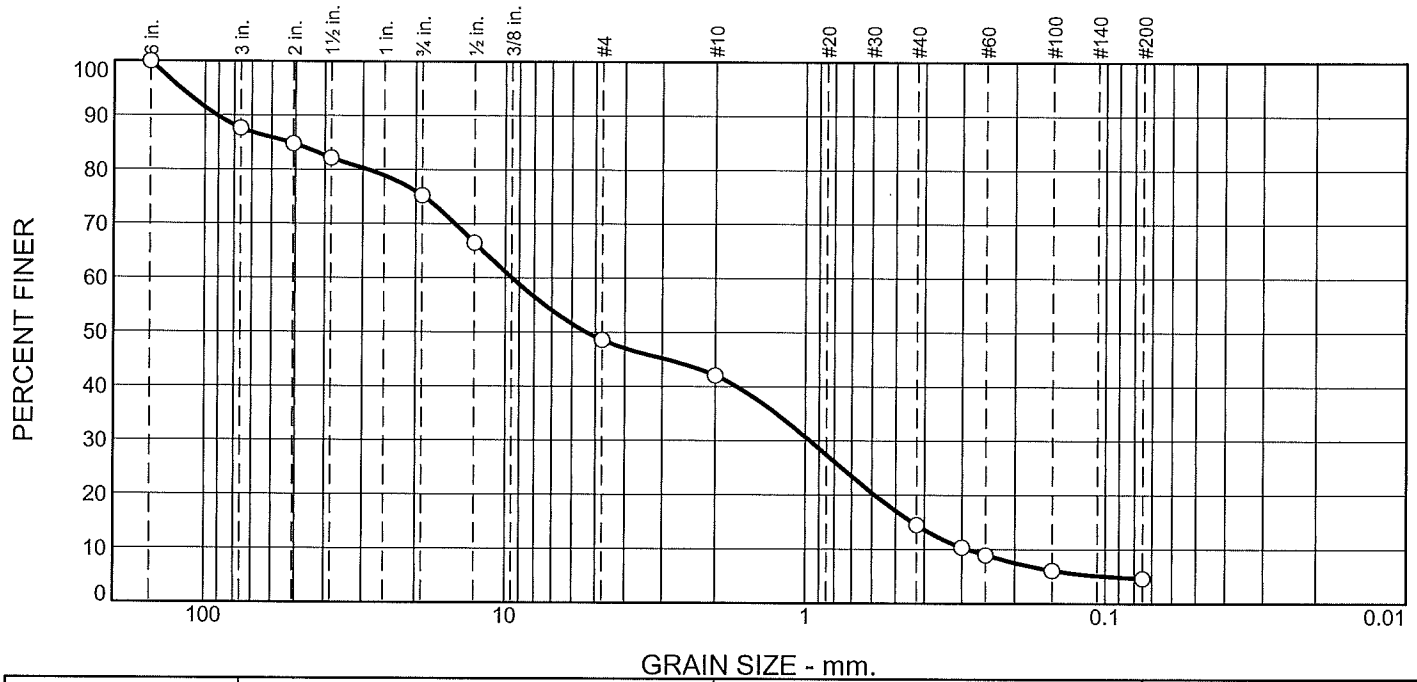
Description: This silty sand is a fair to good foundation when not subject to frost action, having a moderate to high frost potential and exhibiting fair to poor drainage characteristics.

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 6 - 5742' N of Cedar Hill St., 13' off the NB Edge of Pavement, (Utility Pole # 21)
Sample Number: BASE **Depth:** 20 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
12	46	28	9	5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	88	100	X
2"	85		
1-1/2"	82		
3/4"	75		
1/2"	66	50 - 85	
#4	49	40 - 75	
#10	42		
#40	14		
#50	10	8 - 28	
#60	9		
#100	6		
#200	4.6	0.0 - 10	

* MA - M1.03.0 Gravel Borrow "B"

Material Description

poorly graded sand with silt and gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 52.2274 D_{60}= 9.5058 D_{50}= 5.3745
D_{30}= 0.9645 D_{15}= 0.4398 D_{10}= 0.2884
C_u= 32.96 C_c= 0.34

Classification

USCS= SP-SM AASHTO= A-1-a

Remarks

Figure

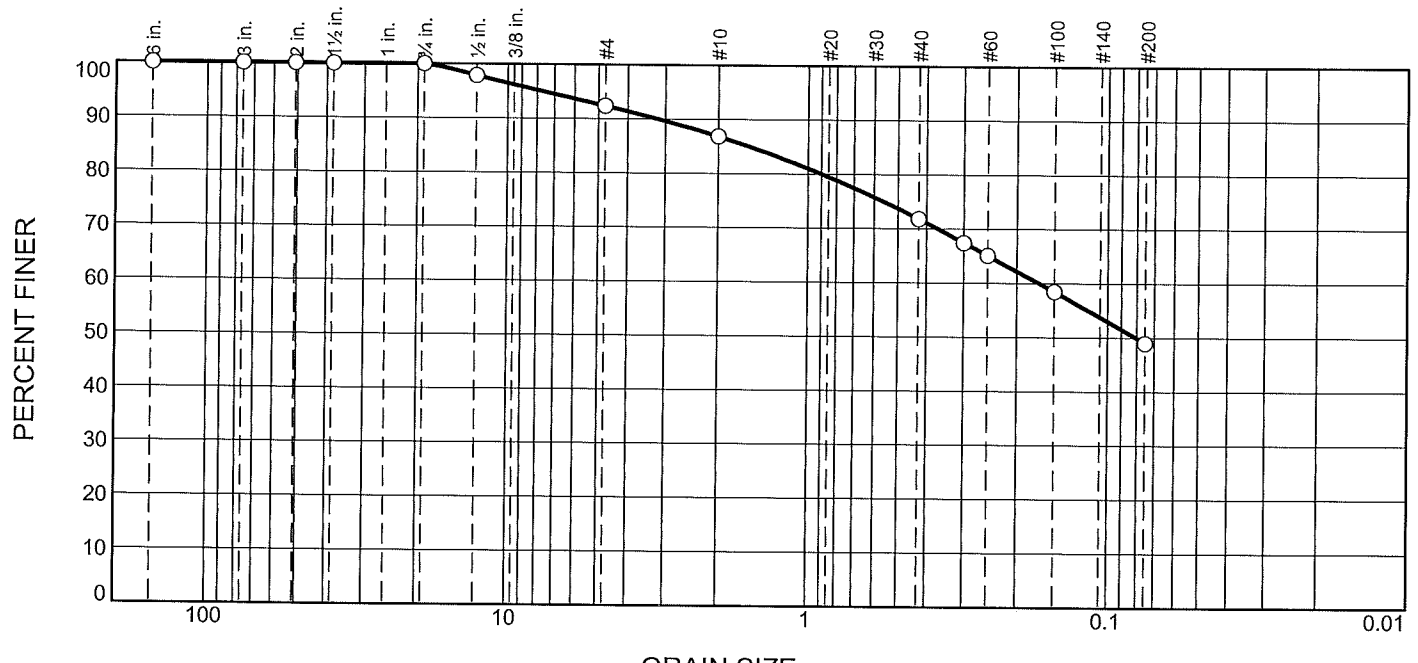
Tested By: JSG/BS **Checked By:** VHB

Vanasse Hangen Brustlin, Inc.

Project: Simarano Drive **Project No.:** 12247.01

Client: Marlborough, MA

Source of Sample: TP 6 - 5742' N of Cedar Hill St., 13' off the NB Edge of Pavement, (Utility Pole # 21)
Sample Number: SUBGRADE **Depth:** 4 **Date:** 8/12/13



% +3"	% Gravel	% Sand		% Fines
		Coarse	Fine	Silt
0	13	15	23	49

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100		
3"	100	100	
2"	100	90 - 100	
1-1/2"	100		
3/4"	100		
1/2"	98		
#4	92	20 - 65	X
#10	87		
#40	72		
#50	67		
#60	65		
#100	58		
#200	49	0.0 - 12	X

* MA - M1.02.0 Special Burrow

Material Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 1.5770 D_{60}= 0.1688 D_{50}= 0.0805
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Figure

Tested By: JSG/BS **Checked By:** VHB

Appendix G: MassDOT Superpave Requirements

SECTION 450
HOT MIX ASPHALT PAVEMENT

Section 450 - Hot Mix Asphalt Pavement entirely replaces the following Sections and Subsections of the Standard Specifications for Highways and Bridges:

- Section 420 - Class I Bituminous Concrete Base Course Type I-1
- Section 460 - Class I Bituminous Concrete Pavement Type I-1
- Subsection M3.01.0 - Asphalt Cement
- Subsection M3.11.06 - Bituminous Materials
- Subsection M3.11.08 - Inspection
- Subsection M3.11.09 - Composition and Compaction Acceptance Tests

The Contractor shall adhere to all of the requirements herein of Section 450, Hot Mix Asphalt Pavement. All QC Inspection Report Forms and Test Report Forms must be submitted to the Department by the Contractor at the completion of each Lot. Material produced and placed must conform to the Quality Limits specified in Subsection 450.77. Contractor QC data and Department Acceptance data for each Lot falling under HMA Lot Category A (Large Lot) or Category B (Small Lot) will be evaluated using Quality Level Analysis and must meet the minimum Percent Within Limits specified in Subsection 450.77.

SECTION 450
HOT MIX ASPHALT PAVEMENT

DESCRIPTION

450.20 General.

This work shall consist of producing and placing Hot Mix Asphalt (HMA) pavement. HMA mixtures shall be composed of the following: Mineral aggregate, mineral filler (if required), Performance Graded Asphalt Binder (PGAB), and as permitted, reclaimed materials (limited to Reclaimed Asphalt Pavement (RAP), Manufactured Asphalt Shingles (MAS), and Processed Glass Aggregate (PGA)). The HMA pavement shall be constructed as shown on the plans and as directed on the prepared or existing base in accordance with these specifications and in close conformity with the lines, grades, compacted thickness and typical cross section as shown on the plans. Unless specified otherwise, each HMA pavement course placed shall be comprised of one of the mixture types listed in Table 450.1.

Table 450.1 - HMA Pavement Courses & Mixture Types

Pavement Course	Mixture Type	Mixture Designation
Friction Course	• Open-Graded Friction Course - Polymer Modified	OGFC-P
Surface Course	• SUPERPAVE Surface Course - 4.75 • SUPERPAVE Surface Course - 9.5 • SUPERPAVE Surface Course - 12.5 • SUPERPAVE Surface Course - 19.0	SSC - 4.75 SSC - 9.5 SSC - 12.5 SSC - 19.0
Intermediate Course	• SUPERPAVE Intermediate Course - 12.5 • SUPERPAVE Intermediate Course - 19.0	SIC - 12.5 SIC - 19.0
Base Course	• SUPERPAVE Base Course - 25.0 • SUPERPAVE Base Course - 37.5	SBC - 25.0 SBC - 37.5
Leveling Course	• SUPERPAVE Leveling Course - 4.75 • SUPERPAVE Leveling Course - 9.5 • SUPERPAVE Leveling Course -12.5	SLC - 4.75 SLC - 9.5 SLC - 12.5
Bridge Surface Course	• SUPERPAVE Bridge Surface Course - 9.5 • SUPERPAVE Bridge Surface Course - 12.5	SSC-B - 9.5 SSC-B - 12.5
Bridge Protective Course	• SUPERPAVE Bridge Protective Course - 9.5 • SUPERPAVE Bridge Protective Course - 12.5	SPC-B - 9.5 SPC-B - 12.5

450.30 Quality Assurance.

A. Quality Assurance Responsibilities.

This is a Quality Assurance Specification wherein the Contractor is responsible for controlling the quality of materials and workmanship and the Department is responsible for accepting the completed work based on the measured quality. Quality Assurance is simply defined as "making sure the Quality of a product is what it should be".

The core elements of Quality Assurance include: Contractor Quality Control (QC), Department Acceptance, Department Independent Assurance (IA), Dispute Resolution, Qualified Laboratories, and Qualified Personnel. Although Quality Assurance utilizes test results to control production and determine acceptance of the HMA, inspection remains as an important element in controlling the process and accepting the product.

The Contractor is responsible for providing an appropriate Quality Control system to ensure that all materials and workmanship meet the required quality levels for each specified Quality Characteristic. The Contractor will perform all required Quality Control inspection, sampling, and testing in accordance with these specifications and the Contractor's Quality Control Plan.

The Department will monitor the adequacy of the Contractor's QC activities and will perform Acceptance inspection, sampling, and testing. The Department's Acceptance information will be utilized in the acceptance determination for each Lot of material produced and placed.

Independent Assurance is the responsibility of the Department's Central Materials Laboratory. The function of IA testing is to periodically provide an unbiased and independent evaluation of the sampling and testing procedures used in the acceptance decision. Contractor QC and Department Acceptance testing procedures and equipment will be evaluated by IA personnel using one or more of the following: observation, calibration checks, split sample comparison, or proficiency samples (homogeneous samples distributed and tested by two or more laboratories). QC and Acceptance testing personnel are evaluated by observation and split samples or proficiency samples.

B. Hot Mix Asphalt Lots & Sublots.

The quality of each HMA pavement course of the same mixture type produced and placed will be inspected, tested, and evaluated on the basis of Lots and Sublots. A Lot is defined as "an isolated quantity of material from a single source which is assumed to be produced or placed by the same controlled process".

The Lot size and corresponding unit of measure is a function of the individual Quality Characteristic evaluated. Lot sizes for Quality Characteristics subject to Department Acceptance are as shown in Table 450.2.

Changes in the target values, material sources, or JMF for an HMA mixture type will constitute a change in Lot, requiring the establishment of a new Lot. All Lots will be properly identified for accurate evaluation and reporting of HMA quality.

Table 450.2 - HMA Lot Sizes

Quality Characteristic	Lot Size & Unit of Measure
PG Asphalt Binder Grading	Total Tons of HMA from all JMFs using the same PGAB Grade (from same PGAB Supplier), produced by a single plant and placed within same construction season.
PG Asphalt Binder Content	Total quantity of an HMA mixture type with same JMF for same individual pavement course, produced by a single plant using the same source of materials and placed at a uniform plan thickness within the same construction season, not to exceed 18,000 tons. (See Table 450.3).
Volumetrics - Air Voids	
In-place Density	
Thickness	
Ride Quality (IRI)	Total length (miles) of individual wheel paths (in all travel lanes and ramps) of in-place HMA with same JMF for same individual pavement course, produced by a single plant and placed within same construction season, and which is located within the same posted speed limit range as defined in Table 450.19
Wheel Path Deviations	

C. HMA Quality Assurance Requirements.

These Specifications establish three categories under which Hot Mix Asphalt Lots will be produced, placed, evaluated and accepted. Table 450.3 below defines each of the Lot categories and outlines the required Quality Assurance activities of the Contractor and the Department. The division of the Lot categories is based on the total estimated contract quantity of each individual HMA mixture type per each project location. For contracts containing multiple Hot Mix Asphalt items, it is possible to have work performed under more than one HMA Lot category.

(1) Determination of Lot Size and Lot Category

When the total contract quantity of an HMA mixture type is < 2,100 tons (1,925 Mg), it shall be classified as a Minor Lot (Category C Lot).

When the total contract quantity of an HMA mixture type is ≥ 2,100 tons (1,925 Mg), but < 7,500 tons (6,875 Mg), it shall be classified as a Small Lot (Category B Lot).

When the total contract quantity of an HMA mixture type is ≥ 7,500 tons (6,875 Mg), but ≤ 15,000 tons (13,750 Mg), it shall be classified as a Large Lot (Category A Lot).

When the total contract quantity of an HMA mixture type is > 15,000 tons (13,750 Mg), each 15,000 tons (13,750 Mg) will represent a Category A Lot. If the quantity remaining after all 15,000 ton (13,750 Mg) Category A Lots is ≤ 3,000 tons (2,750 Mg), it shall be added to the final Lot providing a final Lot quantity not to exceed 18,000 tons (16,500 Mg). If the quantity remaining after all 15,000 ton (13,750 Mg) Category A Lots is > 3,000 tons (2,750 Mg), it shall constitute a separate Category A Lot.

(2) Determination of Sublot Size

Each HMA Lot will be divided into Sublots of uniform size. The size of each HMA Sublot shall be as listed in Table 450.10 and Table 450.17. If the HMA quantity at the end of a Lot is equal to or greater than one half of a full Sublot, then such quantity shall be identified and evaluated as a separate Sublot. If the HMA quantity at the end of a Lot is less than one half of a full Sublot, then such quantity shall be combined with the previous full Sublot quantity and shall be identified and evaluated as the final Sublot.

Table 450.3 - HMA Lot Categories & Quality Assurance Requirements

Quality Assurance Requirements	Category A (Large Lot)	Category B (Small Lot)	Category C (Minor Lot)
Total Quantity for individual Lot of HMA:	≥ 7,500 tons (6,875 Mg), but ≤ 15,000 tons (13,750 Mg) (See Note 1)	≥ 2,100 tons (1,925 Mg), but < 7,500 tons (6,875 Mg)	< 2100 tons (1,925 Mg)
QC Plan Required:	YES	YES	(See Note 2)
Contractor QC Inspection Required:	YES (Subsection 450.64)	YES (Subsection 450.64)	YES (Subsection 450.64)
Contractor QC Testing Required:	YES (Subsection 450.65)	YES (Subsection 450.65)	YES (Subsection 450.65)
Control Strip Required:	YES	NO	NO
Control Charts Required:	YES	NO	NO
Quality Level Analysis Required:	YES	YES	NO
MassDOT Acceptance Inspection & Testing Performed:	Minimum 25% of Sublots (Subsection 450.74)	Minimum 50% of Sublots), But Minimum 3 Sublots (Subsection 450.74)	100% of Sublots (Subsection 450.74)
QC Test Results included in MassDOT Acceptance Determination:	YES (If Validated)	YES (If Validated)	NO
Pay Adjustment Applied:	YES (Subsection 450.92)	YES (Subsection 450.92)	NO

Note 1: Category A Lots shall not exceed 18,000 tons (16,500 Mg) as specified in Subsection 450.30C(1)
Note 2: If all HMA Lots fall under Category C then a QC Plan is not required. However, if any Lots on the project fall under Category A or Category B, then any Category C Lots must be addressed in the QC Plan.

MATERIALS

450.40 General.

Materials shall meet the requirements in the following Subsections of Division III, Materials and as otherwise specified herein:

Asphalt Emulsion	M3.03.0
Hot Poured Joint Sealer	M3.05.0
Asphalt Anti-Stripping Additive	M3.10.0
Job-Mix Formula	M3.11.03
Mineral Aggregate	M3.11.04
Mineral Filler	M3.11.05
Plant Requirements	M3.11.07

450.42 Hot Mix Asphalt Mix Design.

The Contractor shall be responsible for development of all HMA Laboratory Trial Mix Formulas (LTMF). The aggregate gradation structure and target PG Asphalt Binder content of each LTMF for HMA base courses, HMA intermediate courses, and HMA surface courses shall conform to the Control Points in Section 455. The aggregate gradation structure and target PG Asphalt Binder content for Open-Graded Friction Course (OGFC-P) shall conform to the master ranges in M3.11.03 – Table B.

All LTMFs for HMA pavement courses shall be supported by volumetric mix designs. Volumetric mix designs are not required for OGFC-P.

All HMA LTMF's will be submitted to the Engineer with adequate samples of individual ingredients for verification of each proposed mixture. Upon the Engineer's laboratory verification of the LTMF for Category A Lots, a Control Strip will be necessary. Once each LTMF for Category B Lots or Category C Lots is laboratory verified and accepted by the Engineer, the LTMF will become the approved job mix formula (JMF).

Two or more job-mix formulas per HMA mixture type may be approved for a particular plant, however, only HMA conforming to one job-mix formula is permitted to be produced and placed on any given day.

450.44 Reclaimed Asphalt Pavement (RAP).

Reclaimed Asphalt Pavement (RAP) shall consist of the material obtained from the highways or streets by crushing or milling existing HMA pavements. This material shall be transported to the HMA production facility yard and processed through an appropriate crusher so that the resulting material will contain no particles larger than the maximum aggregate size of the HMA mixture in which it will be used. The material shall be stockpiled on a free draining base, covered and kept separate from the virgin aggregates. The material contained in the RAP stockpiles shall have a reasonably uniform gradation from fine to coarse and shall be protected from accumulation of excessive moisture and shall not be contaminated by foreign materials.

The use of RAP will be permitted at the option of the Contractor provided that the end product is in conformance with the approved job-mix formula. The proportion of RAP to virgin aggregate for base course mixtures and intermediate course mixtures shall be limited to a maximum of 40% for drum mix plants and 20% for modified batch plants. The maximum amount of RAP for all surface course mixtures listed in Table 450.1 shall be 15%. No RAP will be allowed in OGFC-P mixtures.

450.46 Manufactured Asphalt Shingles (MAS)

Manufactured Asphalt Shingles (MAS), as defined in M3.11.04, may be used in HMA leveling courses, HMA base courses, and HMA intermediate courses at a maximum rate of 5% by weight only when RAP is not included in the job mix formula. When MAS is used in HMA mixtures containing RAP or other reclaimed materials, the MAS will be considered as part of the overall allowable mass of reclaimed materials in the mixture, as defined in M3.11.06. HMA mixtures containing MAS shall be designed, produced, and placed in accordance with the requirements contained in Section M3.

450.48 Performance Graded Asphalt Binder.

A. Standard Asphalt Binder Grade.

The Asphalt Binder shall be a Performance Graded Asphalt Binder (PGAB) which meets the specification requirements of AASHTO Standard M320. PGAB shall be provided by an Approved Supplier (AS) in accordance with the Approved Supplier Certification (ASC) system outlined in AASHTO R26, "Standard Practice for Certifying Suppliers of Performance Graded Asphalt Binders".

The standard PGAB grade for Massachusetts has been determined based upon the expected minimum and maximum pavement in-service temperature using the ***LTPPBind software*** with a High Reliability (96-98%). Unless indicated otherwise on the Plans or in the Special Provisions, the standard PGAB Grade of PG64-28 shall be used.

B. Asphalt Binder Modifiers for Reclaimed Materials.

For any HMA containing reclaimed materials, an asphalt binder modifier shall be added to the mixture to restore the asphalt binder properties of the reclaimed materials to a level that is consistent with the specified virgin PGAB. If greater than 25% RAP is used in an HMA mixture, the PGAB modifier grade used shall be in accordance with Table 450.4. The type and amount of asphalt binder modifier to be used shall be included as part of the LTMF. Only Performance Graded Asphalt Binders will be used as modifiers and shall meet the requirements of AASHTO M 320. However, the resulting final PGAB grade shall be in accordance with Table 450.4 (or the specified PGAB grade per the contract).

For HMA Category A Lots and Category B Lots incorporating greater than 25% RAP in the LTMF, the Contractor shall perform, as part of the mix design, full binder testing per AASHTO M 320 on samples of asphalt binder recovered from the RAP (by Abson recovery) blended in the appropriate proportion with samples of the virgin PGAB.

For HMA Category A Lots containing greater than 25% RAP, the Contractor shall also perform full binder testing (on asphalt binder recovered from the RAP blended with the virgin PGAB) for the Control Strip and for Quality Control during HMA production and placement as specified in Subsection 450.65.

Table 450.4 - PGAB Grades for HMA Mixtures Containing RAP

Amount of RAP in Mixture	**PGAB Modifier Grade**	**Resulting PGAB Grade**
≤ 25% RAP by Weight of Mixture	None	64-28
> 25% to 40% RAP by Weight of Mixture	52-34	64-28 ± 2ºC

CONSTRUCTION PROCEDURES

450.50 General.

Prior to the start of any work activity addressed in Subsections 450.53 thru 450.59 below, a Construction Quality Meeting shall be held to review the Contractor's Quality Control system. The Contractor shall present and discuss with the Engineer in sufficient detail the specific Quality Control information and activities contained in each section of their QC Plan as outlined in Subsection 450.61 below. The meeting is intended to ensure that the Contractor has an adequate Quality Control system in place and that the Contractor's personnel are fully knowledgeable of the roles and activities for which they are responsible to achieve the specified level of quality. Contractor personnel required to attend the Construction Quality Meeting include; the Project QC Manager, all other QC personnel (production facility and field operations), all Superintendents, and the Foremen for field operations. The Contractor shall provide a copy of the approved QC Plan for each Contractor and Department attendee of the meeting.

450.51 Control of Grade and Cross-Section.

The Contractor will provide a longitudinal and transverse reference system, with a maximum spacing of 100 ft (30 meters), for the purpose of locating and documenting sampling and testing locations and related uses. It is the Contractor's responsibility to clearly mark this reference system in the field. Work related to this reference system is incidental and will be included as part of the Contractor's Quality Control system. The Department shall provide information tying in the Contractor's reference system to the State Mile Marker System.

The Contractor shall furnish, set and maintain all line and grade stakes necessary to guide the automated grade control equipment. Where required these control stakes shall be maintained by the Contractor and used throughout the operations, from the grading of the subbase material up to and including the final course of the pavement.

Under normal conditions, where more than one course of HMA is to be constructed, the use of the string line for grade control may be eliminated or discontinued after the construction of the initial course of HMA. For resurfacing projects, where only one course of HMA is to be constructed, the use of the string line for grade control may be eliminated. The use of approved automation may then be substituted for the string line where lines and grades are found to be satisfactory by the Engineer.

450.52 Weather Limitations.

HMA shall only be placed on dry, unfrozen surfaces and only when the temperature requirements contained in Table 450.5 below are met.

The Contractor may continue HMA placement when overtaken by sudden rain, but only with material which is in transit from the HMA production facility at the time, and then only when the temperature of the HMA mixture is within the temperature limits specified and when the existing surface on the roadway is free of standing moisture.

The construction of HMA pavement shall terminate November 15 and shall not be resumed prior to April 1 except as determined and directed in writing by the Engineer depending upon the necessity and emergency of attendant conditions, weather conditions, and location of the project. Only in extreme cases will the placement of surface courses be permitted between November 15 and April 1. Regardless of any temperature requirements, OGFC-P mixtures shall not be placed after October 31 or before May 1 without the written permission of the Engineer.

Table 450.5 - Temperature Limitations for HMA Placement

HMA Pavement Course	Lift Thickness Inches (mm)	Minimum Air Temperature °F (°C)	Minimum Surface Temperature °F (°C)
Friction Course	1 (25)	50 (10)	55 (13)
Surface Course	< 1¾ (45)	45 (7)	50 (10)
Surface Course	≥ 1¾ (45)	40 (4)*	45 (7)
Intermediate Course	All	40 (4)*	45 (7)
Base Course	All	40 (4)*	45 (7)
Leveling Course	As Specified	45 (7)	50 (10)

*When the air temperature falls below 50° F (10° C), extra precautions shall be taken in drying the aggregates, controlling the temperatures of the materials, and in placing and compacting the mixtures.

The Contractor shall supply the Engineer with an approved dial type thermometer with a temperature range of -50° to 500° F (10° to 260° C) and an infrared pistol thermometer for each paving machine in operation on the project. The infrared pistol thermometer shall be Fahrenheit or Celsius selectable and conform to the following requirements:

- Portable and battery operated
- LCD Display to nearest 1° F (1° C)
- Temperature operating range of 0° to 750° F (–18° to 400° C)
- Accuracy of ± 2%
- Repeatability of +/- 5° F (± 3° C)
- Emissivity preset at 0.95

The thermometers will remain the property of the Contractor upon completion of the project.

450.53 Preparation of Underlying Surface.

HMA mixtures shall be placed only upon properly prepared surfaces that are clean from foreign materials. The underlying surface shall be prepared in accordance with the requirements below, prior to the placement of HMA pavement courses.

A. Subbase or Reclaimed Base.

Prior to the placement of HMA base course mixtures, the Contractor shall inspect the prepared subbase or reclaimed base material to ensure that it is in conformance with the required grade, cross-section, and in-place density. Subbase or reclaimed base material that is not in accordance with the plans or specifications shall be reworked or replaced to meet the applicable requirements of Sections 401, 402, or 403 before the start of HMA placement. The subbase or reclaimed base shall not be frozen or have standing water when placing HMA.

B. Milling Existing HMA Pavement.

When specified on the plans, existing HMA pavement courses shall be milled and removed from the project by the Contractor. Milling shall be performed in conformity with the limits, line, grade, and typical cross-section shown on the plans and in accordance with Section 130, Milling Existing HMA Pavement. All Quality Control activities for milling shall be addressed in the Contractor's HMA QC Plan.

C. Patching Existing Pavement Courses.

Areas of existing HMA pavement courses that are significantly distressed or unsound shall be removed and replaced with patches using new Hot Mix Asphalt. The location and limits of patching will be as identified in the plans or as directed by the Engineer.

Each existing pavement course determined to be unsound shall be removed to the full depth of the pavement course within a rectangular area. For each patch location equal to or greater than 50 square feet (4.6 square meters) in area (and having a minimum dimension of 4 feet (1.2 meters)) where the existing pavement courses are removed down to subbase, the subbase shall be compacted by mechanical means to not less than 95% of the maximum dry density of the subbase material as determined by AASHTO T 99 method C at optimum moisture content. Each edge of the patch area shall be sawcut or otherwise neatly cut by mechanical means to provide a clean and sound vertical face. The vertical face of each edge shall be thoroughly coated with a hot poured rubberized asphalt sealant meeting the requirements of ASTM D3405 immediately prior to placing the HMA patching mixture.

Delaminated areas of existing pavement courses resulting from pavement milling shall be cut back neatly by mechanical means to the limits of any unsound material. After removing all unsound material, the underlying pavement surface within the patch limits shall receive a thorough tack coat at a rate of application of 1/10 gal/s.y. (0.40 liters/square meter) immediately prior to placing the HMA patching mixture.

HMA patching mixture shall be the same mixture type as the existing pavement course being patched or as specified on the plans or as directed by the Engineer. The lift thickness of the patching mixture shall not exceed four times the nominal maximum aggregate size of the mixture. The patching mixture will be placed by hand or by mechanical means and shall match the thickness, grade, and cross-slope of the surrounding pavement. The HMA patching mixture shall be compacted using a steel wheel roller. For patch areas not large enough to permit use of a roller, compaction shall be accomplished using a mechanical tamper capable of achieving the required in-place density. The Contractor shall test the in-place density of each patched area using a calibrated density gauge and record the test data for each patched area on NETTCP Test Report Forms. The in-place density of the HMA patching mixture shall be not less than 92% of the maximum theoretical density of the mixture as determined by AASHTO T 209.

D. Leveling Courses.

HMA Leveling Courses shall only be used when specified in the Plans or Special Provisions. The HMA mixture used for a Leveling Course shall be as specified in the Plans or Special Provisions and shall conform to the relevant Materials requirements of Section 450.

E. Preparation of Curbs, Edging, and Utilities.

All curbs or edging shall be installed or reset to the line and grade established on the plans. The surface elevation of all catch basin frames and grates, manholes, utility valve boxes, or other utility structures located in the pavement shall uniformly match the grade and cross-slope of the final pavement riding surface. Adjustment of all curbs, edging, and utilities shall be completed prior to the placement of the HMA surface course. When OGFC-P is specified to be placed over the HMA surface course, all curbs, edging, and utilities shall be adjusted prior to

placement of the surface course mixture. Hand placement of HMA along curbs and edging or around utilities after placement and compaction of the surface course shall not be permitted.

F. Sweeping Underlying Surface.

The Contractor shall provide a mechanical sweeper equipped with a water tank, spray assembly to control dust, a pick-up broom, a dual gutter broom, and a dirt hopper. The sweeper shall be capable of removing millings and loose debris from the underlying surface.

All milled pavement surfaces shall be thoroughly swept in accordance with Section 130, prior to opening a milled area to traffic, to remove all remaining millings and dust. All other existing pavement surfaces shall be swept immediately prior to application of the tack coat. Any new HMA pavement course that has been open to traffic, or that was placed 30 days prior to placement of the subsequent pavement course, shall also be swept immediately prior to application of the tack coat.

G. Tack Coat.

A tack coat of asphalt emulsion, grade RS-1 shall be uniformly applied to existing or new pavement surfaces prior to placing pavement courses as specified below. The existing surface shall be swept clean of all foreign matter and loose material using a mechanical sweeper and shall be dry before the tack coat is applied.

(1) Tack Distributor System.

A pressure distributor shall be used to apply the tack coat. The tack distributor system shall be equipped with the following to control and monitor the application:

(a) System for heating the asphalt emulsion uniformly to specified temperature.
(b) Thermometer for measuring the asphalt emulsion temperature.
(c) Adjustable full circulation spray bar.
(d) Positive controls including tachometer, pressure gauge, and volume measuring device.

(2) Tack Application Requirements.

The tack coat material shall be applied by a pressure distributor. All nozzles on the distributor shall be open and functioning. All nozzles shall be turned at the same angle to the spray bar. Proper nozzle angle shall be as determined by the manufacturer of the distributor spray bar. The spray bar shall be adjusted so that it is at the proper height above the pavement surface to provide a double overlap spray for a uniform coverage of the pavement surface. A double lap application requires that the nozzle spray patterns overlap one another such that every portion of the pavement receives spray from exactly two nozzles.

When an HMA pavement course is placed on an existing tight smooth pavement surface, a tack coat shall be applied at the rate of 1/20 gal/s.y. (0.20 liters/square meter). All existing surfaces subjected to milling shall receive a tack coat at the rate of 1/15 gal/s.y. (0.28 liters/square meter). Tack coat shall be applied to cover approximately 90% of the pavement surface.

Any new HMA pavement course that has been open to traffic, or that was placed 30 days prior to placement of the subsequent pavement course, shall receive a tack coat at an application rate of 1/20 gal/s.y. (0.20 liters/square meter).

When the surface of a new HMA pavement course is in a condition which in the Engineer's judgment is unsatisfactory for the direct placement of the subsequent pavement course, a tack coat shall be applied at the applicable rate specified above for the particular pavement surface condition.

In addition to the requirements above, all vertical surfaces of curbs, edging, utilities, and drainage structures shall receive a thorough tack coat application immediately prior to placing each HMA pavement course.

(3) Tack Inspection.

The asphalt emulsion temperature and application rate shall be periodically measured and properly recorded by the Contractor on NETTCP Inspection Report Forms. If the temperature or application rate is determined to not be in conformance with the specification requirements above, the Contractor shall make appropriate adjustments to the tack application operations.

450.54 Hot Mix Asphalt Transportation and Delivery.

A. Haul Unit Equipment.

The trucks used to transport HMA to the field placement site shall have tight, clean, smooth metal beds. When necessary to maintain the required HMA temperature, trucks shall be equipped with insulated beds. The truck beds shall be evenly and lightly coated with an approved release agent to prevent HMA mixture adherence. Release agents may consist of soapy water or commercial oil emulsions (also known as soluble oils) in the proportions recommended by the manufacturer. Truck beds shall be kept free of kerosene, gasoline, fuel oil, solvents, or other materials that could adversely affect the HMA mixture. Excess lubricant shall not be allowed to accumulate in low spots in the body. The Contractor shall employ sufficient procedures and QC inspection to ensure that all truck beds are free of contaminants, residual HMA, or excess release agent.

B. HMA Protection During Transport.

The HMA shall be transported from the plant to the field placement site in trucks previously cleaned of all foreign materials. During transportation of the HMA from the plant to the placement equipment at the site, each load shall be fully covered at all times, without exception, with canvas or other suitable material of sufficient size and thickness, which is tightly secured to furnish complete protection. The HMA shall not be transported such a distance that segregation of the mixture takes place or that a crust is formed on the surface, bottom or sides of the HMA.

C. Coordination and Inspection of HMA Delivery.

The dispatching of trucks from the plant shall be continuously coordinated to ensure that all HMA mixture planned to be delivered to the field placement site may be placed and compacted before the end of the scheduled work day. During paving operations, the Contractor shall provide for ongoing two-way radio or cellular phone communication between the field placement site and the HMA plant.

The target temperature and allowable range of the HMA when delivered at the field placement site will be established in the Contractor's Quality Control Plan. The Contractor shall measure the temperature of the HMA, either from the trucks prior to discharge or from the paver hopper, using a metal stemmed dial type thermometer at the minimum frequency indicated in the approved QC Plan. All QC temperature measurement results of the delivered HMA mixture shall be recorded on NETTCP Inspection Report Forms. The Contractor shall also visually inspect the delivered HMA for crusting or material (physical) segregation. The Contractor shall reject any loads of HMA with material which is crusted, segregated, or which is not within the delivery temperature range established in the Contractor's Quality Control Plan.

450.55 Hot Mix Asphalt Placement.

A. Material Transfer Vehicles

For projects on all controlled access highways with HMA Category A Lots, a Material Transfer Vehicle (MTV) will be required. The MTV shall be used to place each pavement

course, with the exception of leveling courses, on the mainline of the traveled way including all travel lanes, auxiliary lanes, and collector/distributor (C/D) lanes.

(1) MTV Equipment Requirements.

The MTV shall be self-propelled and capable of remixing and transferring the HMA mixture to the paver so that the HMA mat behind the paver has a uniform homogeneous temperature and appearance. The MTV shall be equipped with the following:

(a) A truck unloading system, capable of 600 tons per hour (550 Mg per hour), which shall receive HMA from the trucks and independently deliver the mixture from the trucks to the paver.

(b) A paver hopper insert with a minimum capacity of 14 tons (12.7 Mg) shall be installed in the hopper of conventional paving equipment. The paver hopper insert shall be marked to identify the point at which the insert is 50% full.

(c) An internal storage bin with a minimum capacity of 25 tons (22.7 Mg) of mixture and a remixing system in the bottom of the storage bin to continuously blend the mixture as it discharges to a conveyor system; or a dual pugmill system located in the paver hopper insert with two full length longitudinally mounted counter-rotating screw augers to continuously blend and feed the mixture through the paver to the screed.

(2) MTV Operations.

The Contractor shall ensure that the MTV is loaded continuously to keep the paver moving. The volume of HMA in the paver hopper insert shall remain above the 25% capacity mark during all paving operations. In the event the MTV malfunctions during HMA placement operations, the Contractor shall continue placement of material until such time there is sufficient HMA placed to maintain traffic in a safe manner. The Contractor may continue placement of HMA until any additional mixture in transit has been placed. Paving Operations may resume only after the MTV has been repaired and is fully operational.

(3) Bridge Loading Restrictions.

The MTV shall be subject to all bridge load restrictions. The Contractor shall verify the sufficiency of the current bridge ratings with the Engineer. In the event that the MTV exceeds the maximum allowable bridge load, the MTV shall be empty when crossing the bridge and shall be moved across without any other Contractor vehicles or equipment being on the bridge. The MTV shall be moved across the bridge in a travel lane and shall not be moved across the bridge on the shoulder. The MTV shall be moved at a speed no greater than five miles per hour (8 kph) without any acceleration or deceleration.

B. Pavers.

Each HMA pavement course shall be placed with one or more pavers at the specified grade, cross-slope, and lift thicknesses.

(1) Paver Equipment Requirements.

Each paver shall be a self-contained, power propelled unit and shall produce a finished surface of smooth and uniform texture without segregating, tearing, shoving or gouging the HMA. The pavers shall be equipped with the following:

(a) A receiving hopper having sufficient capacity to ensure a uniform and continuous placement operation.

(b) Automatic feed controls, which are properly adjusted to maintain a uniform depth of material ahead of the screed.

(c) Automatic screed controls with sensors capable of sensing the transverse slope of the screed, and providing the automatic signals that operate the screed to maintain grade and transverse slope.

(d) An adjustable vibratory screed with full-width screw augers and heated for the full width of the screed.
(e) Capable of spreading and finishing HMA pavement courses in widths at least 12 inches (300mm) more than the width of one travel lane.
(f) Capable of being operated at forward speeds to satisfactorily place the HMA.

(2) Paver Operations.

The Contractor shall ensure that the paver is loaded continuously to keep the placement operation moving. The volume of HMA in the paver receiving hopper shall remain above the paver tunnel during all paving operations. Proper practices shall be utilized to ensure that HMA is not dumped or spilled onto the prepared underlying surface in front of the paver by trucks unloading into the receiving hopper.

C. HMA Placement Inspection.

The HMA shall be free of identifiable material (physical) segregation or temperature related segregation. The HMA placed shall be a homogeneous mixture that is of uniform temperature. The Contractor shall inspect the HMA in the paver receiving hopper for material (physical) segregation. The Contractor will also inspect the uncompacted HMA mat behind the paver for longitudinal streaks, end-of-load segregation or other irregularities.

The Contractor shall also measure the temperature differential in the uncompacted mat behind the paver. Each HMA pavement course behind the paver shall be divided into longitudinal Sublots of 500 feet (150 meters). The mat temperature differential of the uncompacted HMA shall be measured at a minimum of one location in each Sublot along a straight transverse line behind the paver at a minimum frequency of once per Sublot. The transverse line for mat temperature measurement shall be established at a distance within 10 feet (3 meters) behind the paver screed. Temperature measurements shall be obtained by the Contractor using an infrared pistol thermometer at two (2) foot intervals along the transverse line across the width of the mat and recorded on NETTCP Inspection Report Forms. The difference between the highest and lowest temperature measurement shall not exceed 20°F (10°C).

If the maximum mat temperature differential is exceeded, or if material segregation or irregularities in the HMA mat behind the paver are noted, the Contractor shall review the production, transportation, and placement operations and take corrective action. The Contractor shall make every effort to prevent or correct any irregularities in the HMA, such as changing pavers or using different and additional equipment. The Contractor's Quality Control Plan shall fully outline procedures for inspecting the HMA mat during placement, identifying and troubleshooting material segregation or temperature related segregation, and implementing corrective action.

450.56 Hot Mix Asphalt Compaction.

A. Compaction Equipment Requirements.

The Contractor shall employ compaction equipment as outlined in the approved Quality Control Plan. Equipment used for compaction of HMA Base Courses, Intermediate Courses and Surface Courses may include steel wheeled rollers, vibratory rollers, oscillation rollers, or pneumatic-tired (rubber tired) rollers as determined appropriate by the Contractor for the particular mixture type being placed. The number and type of rollers used for breakdown, intermediate, and finish rolling shall be sufficient to achieve the target in-place density and specified course thickness.

B. Compaction Operations.

The rollers shall not crush the aggregate in the HMA mixture and shall be capable of reversing without shoving or tearing the mixture. The Contractor shall outline in the Quality Control Plan the proposed rolling sequence for each HMA pavement course to be placed. For HMA Category A Lots, the initial rolling pattern for each pavement course will be confirmed or adjusted during placement of the Control Strip in accordance with the requirements of Subsection 450.66B. As Lot placement progresses during the construction season, the rolling pattern shall be adjusted as necessary to achieve the specified HMA in-place density.

C. Compaction of Open-Graded Friction Course.

Vibratory rollers, oscillation rollers, or rubber tire rollers will not be permitted on Open Graded Friction Course (OGFC-P) mixtures. Initial rolling of OGFC-P should be accomplished with the breakdown roller within a short distance of the paver. Any subsequent rolling shall be accomplished without over-rolling the mixture. Breakdown and intermediate rolling of
OGFC-P shall be completed before the material has cooled to 195°F (90°C).

D. Inspection & Testing of Compacted HMA.

The compacted HMA pavement course shall be free of material (physical) segregation and shall meet the requirements for in-place density, thickness, and ride quality specified in Subsection 450.65F. The Contractor shall inspect each Sublot of HMA throughout the compaction operation and shall further inspect the in-place HMA after Sublot completion and identify any areas of visible material (physical) segregation. The Contractor shall reject any in-place Sublot of HMA which is determined to be segregated through procedures established in the Quality Control Plan. The Contractor will also test each Sublot for in-place density, thickness, and ride quality as specified in Subsection 450.65F.

450.57 Hot Mix Asphalt Joints.

The Contractor shall plan the sequence of HMA placement to minimize transverse and longitudinal joints in each pavement course. Paving operations should employ long pulls or tandem pavers, whenever practicable, to reduce the number and length of joints.

A. Transverse Joints.

Where the start or end of a new HMA pavement course meets existing HMA pavement, the existing pavement shall be sawcut to form a transverse butt joint for the full depth of all new pavement courses. The sawcut shall follow a straight line and provide a clean and sound vertical face. Material at any intermediate transverse joint resulting from suspension of placement of a new HMA pavement course shall also be sawcut and removed to provide a clean vertical face before continuing placement of the pavement course.

When traffic is to be carried over any transverse joint before completion of an HMA pavement course, the Contractor shall provide a temporary tapered joint with a maximum 12:1 slope. The HMA mixture forming the taper shall be placed on heavy wrapping paper or other suitable material to serve as a bond breaker. The temporary tapered joint shall be sawcut to reveal the full depth of the pavement course and form a transverse butt joint with a clean vertical face. The temporary tapered joint material shall be completely removed before resuming placement of the HMA pavement course.

Prior to the start of HMA placement at each transverse joint, the vertical joint face shall be thoroughly coated with a hot poured rubberized asphalt sealant meeting the requirements of ASTM D3405, with a minimum of 15% ground reclaimed tire rubber. The asphalt sealant temperature and application rate for each pavement course shall be established in the

Contractor's Quality Control Plan. No reheating of the joint face shall be permitted. Equipment used to apply the hot poured rubberized asphalt sealant shall be capable of maintaining the sealant at the established temperature and application rate sufficient to uniformly coat the vertical joint face without runoff or accumulation of the asphalt sealant.

B. Longitudinal Joints.

All longitudinal joints in HMA surface courses shall be located on the roadway centerline or on a lane line or edge line of the traveled way. The longitudinal joints in each pavement course below the surface course shall be successively offset from the joint in the surface course by no more than 12 inches (300 mm) and no less than six inches (150 mm).

(1) Vertical Joints.

When an HMA pavement course is placed using single paver pulls, the Contractor shall employ suitable equipment to confine the longitudinal edge of the HMA mixture to establish an edge that is near vertical. For all HMA surface course mixtures placed, when the Contractor's placement operations do not provide a confined and near vertical edge, the longitudinal edge of the surface course shall be sawcut full depth and removed to provide a clean vertical face before placement of the adjacent course of HMA.

All longitudinal joint edges of HMA surface courses, regardless of whether the joint edge is required to be sawcut, shall be treated prior to placing the adjacent pull of HMA. The vertical joint shall be coated with a hot poured rubberized asphalt sealant meeting the requirements of ASTM D3405, with a minimum of 15% ground reclaimed tire rubber. The asphalt sealant shall be applied at a sufficient temperature and application rate sufficient to uniformly coat the vertical joint face without runoff or accumulation of the sealant. The asphalt sealant temperature and application rate shall be established in the Contractor's Quality Control Plan. No reheating of the joint shall be permitted.

When placing an HMA surface course with pavers in tandem, the use of the hot poured rubberized asphalt sealant will be omitted, provided the temperature of the mixture at the longitudinal joint does not fall below 200ºF (95ºC) prior to the placement of the adjacent mat.

When the longitudinal edge of any HMA pavement course is placed against an adjoining edge such as existing pavement, curb, gutter, drainage or utility structure, or any metal surface, a tack coat shall be uniformly applied to the entire vertical joint surface in accordance with Subsection 450.53 prior to placement of the HMA.

(2) Wedge Joints.

The Contractor may use a longitudinal wedge joint when placing HMA pavement courses at a thickness of 1.75 inches (45 mm) or greater.

When a wedge joint is proposed for use, the joint detail shall be included in the Contractor's QC Plan. The wedge joint shall include a notched vertical edge with a minimum depth of 0.5 inches (12.5 mm). The sloped surface of the wedge joint shall not exceed a 6:1 slope. The Contractor shall use a commercially manufactured wedge joint attachment to the paver, or other attachment approved by the Engineer, to form the wedge joint.

Hot poured rubberized asphalt sealant shall not be applied to wedge joints. A tack coat shall be applied to the entire surface of the wedge joint in accordance with Subsection 450.53 prior to placement of the adjacent pull of HMA.

C. Inspection & Testing of HMA Joints.

The hot poured rubberized asphalt sealant temperature and application rate shall be measured and properly recorded by the Contractor on NETTCP Inspection Report Forms a minimum of once per transverse joint and once per 1,000 feet (300 meters) of longitudinal joint. If the temperature or application rate is determined to not be in conformance with the

requirements established in the Contractor's Quality Control Plan, the Contractor shall make appropriate adjustments to the asphalt sealant application operations.

The placement and compaction of HMA at each transverse joint or longitudinal joint shall provide a tight bond between the existing pavement and the new pavement course. The Contractor shall visually inspect each transverse joint and longitudinal joint throughout the placement and compaction operations and shall further inspect the joints after Sublot completion and identify any bumps, depressions, openings, or other visible defects. The Contractor shall reject any in-place Sublot of HMA which is determined to have defective joints through procedures established in the Quality Control Plan.

Finished joint surfaces shall be smooth and true to the required grade and cross-slope without deviations exceeding 0.25 inches (6 mm), both transversely and parallel to the joint, when measured with a 10 foot (3 meter) standard straightedge. The in-place density of the completed HMA pavement course, within 1 foot (300 mm) of either side of the finished joint, shall be not less than 90% of the maximum theoretical density of the mixture as determined by AASHTO T 209. The Contractor will measure the surface smoothness and test the in-place density of each transverse joint and longitudinal joint of each Sublot of HMA as specified in Subsection 450.65F. All joint inspection and testing data shall be recorded on NETTCP Inspection Report Forms and Test Report Forms.

450.58 HMA Pavement on Bridges.

A. Bridge Course Mixture Requirements.

HMA pavement courses for bridge decks shall consist of a bridge protective course, placed first, followed by a bridge surface course. Unless specified otherwise on the plans, the bridge protective course mixture shall consist of Dense Binder treated with an approved anti-stripping compound as specified under M3.10.0.

The bridge protective course and bridge surface course shall be placed only after all curbing and edging, when included in the work, are in place. The bridge protective course shall be placed within 24 hours after the membrane waterproofing has been placed, unless an exception is granted by the Engineer. No vehicular traffic shall be permitted over any bare membrane waterproofing except as provided for under Subsection 965.62. Equipment used for placement and compaction of the bridge protective course and bridge surface course shall be sufficient to place the HMA mixture at the required grade, cross-slope, thickness, and in-place density without damaging the underlying membrane waterproofing.

B. Inspection & Testing of Bridge Course Mixtures.

The Contractor shall inspect and test each Sublot of bridge protective course HMA mixture and bridge surface course HMA mixture in accordance with the requirements for mixture temperature, mat temperature, segregation, and joint quality as specified in Subsections 450.54 through 450.57. QC sampling and testing of each Sublot shall be performed for all HMA loose mix Quality Characteristics specified in Subsection 450.65F. The in-place density of the bridge protective course and bridge surface course shall be randomly tested using a calibrated density gauge and the test data recorded on NETTCP Test Report Forms. The in-place density of the bridge protective course and bridge surface course shall be not less than 90% of the maximum theoretical density of the mixture as determined by AASHTO T 209 and tested per AASHTO TP-68 or ASTM D2950. Cores shall only be allowed for Dispute Resolution. When the HMA bridge surface course is placed in conjunction with mainline pavement, QC testing for ride quality shall be performed as specified in Subsection 450.65F(11).

450.59 Opening to Traffic.

No vehicular traffic or loads shall be permitted on the newly completed HMA pavement until adequate stability has been attained and the material has cooled sufficiently to a temperature of 140° F (60° C) or less as indicated by a surface type thermometer. The Contractor shall clearly outline, in the Quality Control Plan, the specific criteria related to opening new pavement to traffic.

HMA cores shall be obtained by the Contractor for all Sublots placed each day in accordance with the approved Quality Control Plan prior to opening to traffic. At the discretion of the Engineer, based on climactic or other conditions, obtaining of cores may be delayed for a period up to, but not to exceed, 48 hours. In the event of force majeure resulting from direction by Traffic Police or the Engineer, the Contractor shall document the event and may submit a claim in accordance with current Department procedures. In such event, the affected Sublots will be isolated from the relevant HMA Lot and the HMA quality will be evaluated as a separate Lot.

CONTRACTOR QUALITY CONTROL

450.60 General.

The Contractor shall provide a Quality Control (QC) system, as outlined in their Quality Control Plan, adequate to ensure that all materials and workmanship meet the required quality levels for each specified Quality Characteristic. The Contractor shall provide qualified QC personnel and QC laboratory facilities and perform Quality Control inspection, sampling, testing, data analysis, corrective action (when necessary), and documentation as outlined further below.

450.61 Contractor Quality Control Plan.

For projects with HMA Category A Lots (Large Lot) or Category B Lots (Small Lot), the Contractor shall provide and maintain a detailed Quality Control Plan, hereinafter referred to as the "QC Plan". If all HMA Lots fall under Lot Category C (Minor Lot) then a QC Plan is not required. However, if any Lots on the project fall under Lot Category A or Category B, then any Category C Lots must be addressed in the QC Plan. The QC Plan should sufficiently document the QC processes of all Contractor parties (i.e. Prime Contractor, Subcontractors, Producers) performing work required under Section 450. The QC Plan is not intended to be a generic document, but rather must be project specific.

A. QC Plan Submittal Requirements.

At the pre-construction conference, the Contractor shall be prepared to discuss the Quality Control Plan. Information to be discussed shall include the proposed QC Plan submittal date, QC organization, and sources of materials. The Contractor shall submit one (1) hard copy and one (1) electronic copy of the QC Plan to the Engineer for approval not less than forty-five (45) days prior to the start of any work activities related to HMA pavement construction (including preparation of underlying surface) addressed in Subsections 450.53 thru 450.59. The Contractor shall not start work on the subject work items without an approved QC Plan.

B. QC Plan Format and Contents.

The QC Plan shall be structured to follow the format and section headings outlined below. and as outlined in further detail in the New England Transportation Technician Certification Program (NETTCP) "Model QC Plan" for HMA. In the event of discrepancies between the section headings below and the NETTCP Model QC Plan, the current version of the Model QC Plan shall take precedence. The pages of the QC Plan shall be sequentially numbered. The QC Plan shall address, in sufficient detail, the specific information requested under each section and subsection contained in the NETTCP Model QC Plan.

C. QC Plan Approval and Modifications.

Approval of the QC Plan will be based on the inclusion of the required information. Revisions to the QC Plan may be required prior to approval for any part of the QC Plan that is determined by the Department to be insufficient. Approval of the QC Plan does not imply any warranty by the Engineer that the QC Plan will result in completed work that complies with the specifications. It remains the responsibility of the Contractor to demonstrate such compliance. The Contractor may modify the QC Plan as work progresses when circumstances necessitate changes in Quality Control personnel, laboratories, or procedures. In such case, the Contractor shall submit an amended QC Plan to the Department for approval a minimum of three calendar days prior to the proposed changes being implemented.

Quality Control Plan Outline

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450.62 Quality Control Personnel Requirements.

The Contractor's Quality Control organization shall, at a minimum, consist of the personnel outlined below that meet the described minimum qualifications. Every effort should be made to maintain consistency in the Quality Control organization, however substitution of qualified personnel shall be allowed. When circumstances necessitate substitution of QC personnel not originally listed in the approved QC Plan, the Contractor shall submit an amended QC Plan for approval in accordance with Subsection 450.61C.

A. Quality Control Manager.

The Contractor's Quality Control system and QC Plan shall be administered by a qualified project assigned Quality Control Manager (QC Manager). The QC Manager must be a full-time employee of the Contractor or a Quality Control consultant engaged by the Contractor. The QC Manager shall have full authority to institute any and all actions necessary for the successful implementation of the QC Plan. The QC Manager (or their assistant in the QC Manager's absence) shall be available to communicate with the Engineer at all times.

Principal responsibilities of the QC Manager shall include preparation and submittal of the Contractor's QC Plan, managing the activities of all QC personnel, communicating on quality issues within the Contractor's organization, and ensuring that all requirements outlined in the approved QC Plan are met.

For all projects with HMA Category A Lots (Large Lot), the QC Manager shall be certified by the NETTCP as a Quality Assurance Technologist. For projects having only HMA Category B Lots or Category C Lots, the Contractor may submit alternate qualifications for the QC Manager acceptable to the Department.

B. Production Facility Quality Control Technician(s).

All Contractor Quality control sampling, testing, and inspection conducted at the HMA production facility shall be performed by qualified Production Facility Quality Control Technicians (Plant QCTs). The Contractor shall provide a sufficient number of Plant QCTs to adequately implement the minimum Quality Control requirements contained in Section 450 and as outlined in the approved QC Plan. A minimum of one (1) qualified Plant QCT shall be present at each production facility location. HMA will not be accepted by the Department unless the Plant QCT is physically present at the plant during production and correctly performs the required Quality Control inspection, testing and documentation.

All Plant QCTs shall be certified as a HMA Plant Technician by the NETTCP.

C. Laboratory Quality Control Technician(s).

Any QC testing that is performed at off site laboratories (i.e. other than at the production facility or field site) shall be performed by qualified Laboratory Quality Control Technicians (Laboratory QCTs). The Contractor shall provide a sufficient number of Laboratory QCTs to adequately implement the minimum Quality Control requirements contained in Section 450 and as outlined in the approved QC Plan.

All Laboratory QCTs shall be certified as a HMA Plant Technician by the NETTCP.

D. Field Quality Control Technician(s).

All Contractor Quality Control sampling, testing, and inspection conducted at the HMA field placement site shall be performed by qualified Field Quality Control Technicians (Field QCTs). The Contractor shall provide a sufficient number of Field QCTs to adequately implement the minimum Quality Control requirements contained in Section 450 and as outlined in the approved QC Plan. A minimum of one (1) qualified Field QCT will be present at each field placement site. HMA will not be accepted by the Department unless the Field QCTs is physically

present at the site during pre-placement and placement operations and correctly performs the required Quality Control inspection, testing and documentation.

All Field QCTs shall be certified as a HMA Paving Inspector as certified by the NETTCP.

450.63 Quality Control Laboratory Facility Requirements.

All Contractor Quality Control testing shall be performed in laboratories qualified through the NETTCP Laboratory Certification Program (LCP) or accredited through the AASHTO Accreditation Program (AAP). Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The QC Manager shall have overall responsibility for ensuring that all laboratories utilized for Quality Control are in compliance with the requirements of the NETTCP LCP. This includes providing required AASHTO, ASTM, and NETTCP reference documents and ensuring that all required equipment and tools are properly functioning and calibrated.

The Engineer shall be permitted unrestricted access to inspect and review the Contractor's laboratory facility. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. Deficiencies shall be grounds for the Engineer to order an immediate stop to incorporating materials into the work until deficiencies are corrected. The Engineer shall be provided with laboratory space and the availability of laboratory testing equipment to conduct Acceptance testing at the HMA plant.

450.64 Quality Control Inspection.

The Contractor shall perform Quality Control inspection of all work items addressed under Section 450. Inspection activities during HMA production and placement may be performed by qualified Production personnel (e.g. Skilled Laborers, Foremen, and Superintendents). However, the Contractor's QC personnel shall have overall responsibility for QC inspection. The Contractor shall not rely on the results of Department Acceptance inspection for Quality Control purposes. The Engineer shall be provided the opportunity to monitor and witness all QC inspection.

Quality Control inspection activities must address the following four primary components:

- Equipment
- Materials
- Environmental Conditions
- Workmanship

The minimum frequency of Quality Control inspection activity shall be in accordance with the requirements below and as outlined in the approved QC Plan. The results and findings of QC inspection shall be documented on NETTCP Inspection Report Forms (IRFs).

A. QC Inspection for Preparation of Underlying Surface.

The Contractor's personnel will perform Quality Control inspection during preparation of the underlying surface in accordance with the requirements of Subsection 450.53. The minimum items to be inspected shall be as outlined in Table 450.6 and Table 450.7. The Contractor shall identify in the QC Plan the specific inspection activities necessary to ensure the quality of the work, including any additional inspection activities not specifically listed in Table 450.6 and Table 450.7.

Table 450.6 - Minimum QC Inspection of HMA Patching Operations

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC Plan	Per QC Plan	Per QC Plan	Per QC Plan
Materials	Aggregates & PG Binder (Correct Type)	Per QC Plan	HMA Production Facility	Visual Check + Manufacturer COC
	Rubberized Asphalt Sealant (Correct Type)	Per QC Plan	Per QC Plan	Check Manufacturer COC
	Temperature of HMA Mix	4 per Day(1)	From Haul Vehicle at Patching Site	Check Measurement
Environmental Conditions	Underlying Surface Soundness & Moisture	Per QC Plan	Underlying Surface	Visual Check
	Temperature of Air & Underlying Surface	1 per Day(2)	At Patching Site	Check Measurement
Workmanship	Sawcut Limit Vertical Face	Per QC Plan	Sawcut Limits	Visual Check
	Rubberized Asphalt Sealant Application Rate	Per QC Plan	Sawcut Limits	Check Measurement
	HMA Lift Thickness	Per QC Plan	HMA Lift	Check Measurement
	Cross-Slope & Profile	Per QC Plan	Compacted HMA	Check Measurement

(1) The initial temperature measurements will be taken from haul vehicles on the first or second load.

(2) As a minimum, the temperature measurements of the air and underlying surface shall be obtained prior to starting the HMA patching placement.

Table 450.7 - Minimum QC Inspection of Tack Coat Operations

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC Plan	Per QC Plan	Per QC Plan	Per QC Plan
Materials	Asphalt Emulsion (Correct Type)	Per QC Plan	Per QC Plan	Check Manufacturer COC
	Asphalt Emulsion Temperature	(See Note 1)	From Tack Distributor System	Check Measurement
Environmental Conditions	Underlying Surface Cleanliness & Moisture	Per QC Plan	Underlying Surface	Visual Check
	Temperature of Air & Underlying Surface	1 per Day(2)	At Paving Site	Check Measurement
Workmanship	Asphalt Emulsion Application Rate	(See Note 1)	From Tack Distributor System	Check Measurement

(1) The Asphalt Emulsion Temperature and Application Rate shall be checked as follows:

- After application of the first 1,000 lane-feet (300 lane-meters) per HMA pavement course.
- After application of the next 1,500 lane-feet (450 lane-meters) per HMA pavement course.
- After application of the next 2,500 lane-feet (750 lane-meters) per HMA pavement course.
- Thereafter, a minimum of once per 5,000 lane-feet (1500 lane-meters) each day.

(2) As a minimum, the temperature measurements of the air and underlying surface shall be obtained prior to starting the tack coat placement.

B. QC Inspection for Production & Placement of HMA Lots.

The Contractor's QC personnel will perform Quality Control inspection at both the HMA production facility and at the site of HMA field placement to ensure that the production and placement processes are providing work conforming to the contract requirements. The minimum items to be inspected for each HMA Lot shall be in accordance with the requirements of Subsection 450.54 thru Subsection 450.59 and as outlined in Table 450.8a and Table 450.8b. The Contractor shall identify in the QC Plan the specific inspection activities necessary to ensure the quality of the work, including any additional inspection activities not specifically listed in Table 450.8a and Table 450.8b.

(1) Wheel Path Deviations.

A wheel path is defined as 3 feet (1 meter) from and parallel to each longitudinal edge of a travel lane. Each wheel path for all HMA pavement course Lots shall be inspected for Wheel Path Deviations (high points or low points). Inspection shall be performed using a 10-foot (3 meter) standard straightedge in the longitudinal direction on each wheel path. The Sublot size and minimum frequency of QC inspection for Wheel Path Deviations shall be as specified in Table 450.8b, and in the approved Contractor Quality Control Plan. Each random inspection location shall be established by determining a randomly selected distance along the wheel path in accordance with ASTM D3665. Additional selective QC inspection for Wheel Path Deviations within each Sublot of compacted HMA pavement courses shall be as determined necessary by the Field QCT and as specified in the Contractor's approved QC Plan.

The variation from the edge of the 10-foot (3 meter) straightedge to the top of the wheel path surface between any two contact points in the wheel path shall not exceed 0.25 inches (6 mm). The Contractor shall correct any location in a pavement course wheel path not meeting

this requirement. The corrective method(s) proposed by the Contractor shall be subject to the approval of the Department and shall be performed at the Contractor's expense. The Contractor shall re-inspect any Sublots where corrections are made and provide the Department with a copy of the inspection data for the corrected Sublots.

Table 450.8a - Minimum QC Inspection at HMA Production Facility

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC Plan	Per QC Plan	Per QC Plan	Per QC Plan
Materials	PG Binder (Correct Type)	Per QC Plan	HMA Production Facility	Visual Check + Manufacturer COC
	Aggregates (Correct Type)	Per QC Plan	HMA Production Facility	Visual Check
	RAP	Per QC Plan	HMA Production Facility	Visual Check
	MAS	Per QC Plan	HMA Production Facility	Visual Check + Manufacturer COC
	Release Agent	Per QC Plan	Haul Vehicle Bed at Plant	Check QPL + Visual Check + Manufacturer COC
	Temperature of HMA Mix at Plant	4 per Day(1)	From Haul Vehicle at Plant	Check Measurement
Environmental Conditions	Stockpile Moisture	Per QC Plan	HMA Production Facility	Visual Check
	Air Temperature & Precipitation Forecast	1 per Day(2)	HMA Production Facility	Check Measurement
Workmanship	Uncoated Mixture	Per QC Plan	HMA Production Facility	Visual Check
	Excess Blue Smoke or Moisture	Per QC Plan	HMA Production Facility	Visual Check
	Burnt Mix	Per QC Plan	HMA Production Facility	Visual Check
	Physical Segregation	Per QC Plan	HMA Production Facility	Visual Check

(1) The initial temperature measurements shall be taken from the first or second load.

(2) As a minimum, the air temperature measurements and precipitation forecast shall obtained prior to starting the HMA Plant operation.

Table 450.8b - Minimum QC Inspection at HMA Placement Location

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC Plan	Per QC Plan	Per QC Plan	Per QC Plan
Materials	Rubberized Asphalt Sealant (Correct Type)	Per QC Plan	Per QC Plan	Check Manufacturer COC
	Temperature of Delivered HMA Mix	4 per Day(1)	From Haul Vehicle or Paver Hopper	Check Measurement
Environmental Conditions	Underlying Surface Soundness & Moisture	Per QC Plan	Underlying Surface	Visual Check
	Temperature of Air & Underlying Surface	1 per Day(2)	At Paving Site	Check Measurement
Workmanship	Joint Location & Alignment	Per QC Plan	Per QC Plan	Visual Check
	Sawcut Joint Vertical Face	Per QC Plan	Joint Vertical Face	Visual Check
	Rubberized Asphalt Sealant Application Rate	Once per 1,000 ft (300 meters) per joint	Joint Vertical Face	Check Measurement
	Temperature Differential in HMA Mat	Once per 500 feet (150 meters) per pavement course	HMA Mat Behind Paver	Per Subsection 450.55C
	Physical Segregation	Per QC Plan	HMA Mat Behind Paver & Compacted HMA	Visual Check
	HMA Lift Thickness	Per QC Plan	HMA Lift	Check Measurement
	Cross-Slope	Per QC Plan	Compacted HMA	Check Measurement
	Joint Tightness	Per QC Plan	Compacted HMA	Visual Check
	Joint Surface Deviations	Once per 500 feet (150 meters) per joint	At Finished Joint	10 foot (3 meter) standard straightedge
	Wheel Path Deviations	Once per 2,000 ft (600 meters) per Wheel Path	Wheel Path	10 foot (3 meter) standard straightedge

(1) The initial temperature measurements will be taken from the first or second load.

(2) As a minimum, the temperature measurements of the air and underlying surface shall be obtained prior to starting the HMA placement.

450.65 Quality Control Sampling and Testing Requirements.

The Contractor's QC personnel will perform Quality Control sampling and testing at both the HMA production facility and at the site of HMA field placement to ensure that the production and placement processes are providing work conforming to the contract requirements. The Engineer will not sample or test for Quality Control or assist in controlling the Contractor's operations. All QC sampling and testing shall be in accordance with the AASHTO, ASTM, NETTCP, or Department procedures specified in Table 450.9 and Table 450.10. The Contractor shall furnish approved containers for all material samples. The Engineer shall be provided the opportunity to monitor and witness all QC sampling and testing.

A. Random Sampling.

The Contractor's Quality Control system shall utilize stratified random sampling of each Lot produced and placed to assure that all material within the Lot has an equal probability of being selected for testing.. The Contractor's qualified QC personnel shall obtain random QC samples at the minimum frequencies specified in Table 450.9 and Table 450.10. In all cases, application of the specified QC sampling frequencies shall result in a minimum one random sample per Sublot.

Random sample locations shall be determined using the random number tables and procedures contained in ASTM D 3665 or an electronic random number generator, as presented by the NETTCP. The determination of all random sample locations shall be documented on NETTCP Standard Test Report Form D3665. The Contractor will provide the Engineer with the random QC sampling locations selected and documented for each Sublot prior to production and placement of the relevant Sublots.

B. Selective Sampling.

The Contractor's Quality Control system will also utilize selective sampling (i.e. non-random samples) as needed to provide supplemental information to assist in maintaining all production and placement processes in control. The Contractor's qualified QC personnel shall obtain selective QC samples from any Sublot as determined necessary and in accordance with the guidelines established in the approved QC Plan.

C. QC Sample Identification System.

The Contractor shall establish a reliable system for the identification of all QC samples obtained. All PG Asphalt Binder samples, HMA loose mixture samples, and core samples shall be correctly labeled with the following minimum information:

(a) Contract No.
(b) Date of Sample.
(c) Mixture Type.
(d) Lot & Sublot No.
(e) Sample No.
(f) Sample Type (i.e. Random or Selective).
(g) Sample Location (e.g. Station & Offset).

All QC sampling data for Ride Quality and Wheel Path Deviations will be identified by the Contractor as directed by the Engineer. The Contractor's system and procedures for identification of QC samples shall be outlined in the approved QC Plan.

D. Retention of Split Samples.

The Contractor's qualified QC personnel shall obtain all material samples (PGAB samples, HMA loose mix samples, and cores) for QC testing. The Contractor will retain split samples from each PGAB sample and HMA loose mix sample and provide a split sample to the Engineer if requested. The Contractor shall retain the original core samples after testing to serve as "split samples" and protect them from damage. All split samples shall be properly labeled and stored for a period of (30) days, or until tested. These split samples (PGAB samples, HMA loose mix samples, and cores) will be utilized if necessary, in the Dispute Resolution process. If mutually agreed upon by the Contractor and the Department, the retained split samples may be discarded prior to the required thirty (30) days.

E. Quality Control Testing of Prepared Underlying Surface.

The Contractor's QC personnel will perform Quality Control testing during preparation of the underlying surface. All QC testing shall be in accordance with the AASHTO, ASTM, NETTCP, or Department procedures specified in Table 450.9. The Engineer shall be provided the opportunity to monitor and witness all QC testing.

Table 450.9 - Minimum QC Sampling & Testing of Prepared Underlying Surface

Quality Characteristic	Test Method(s)	Sublot Size	Minimum Test Frequency	Point of Sampling	Sampling Method
HMA Patching Mixture: PG Asphalt Binder Content	AASHTO T164 or AASHTO T308	150 tons (140 Mg)	1 per Sublot	From Haul Vehicle at Plant	Random AASHTO T168
HMA Patching Mixture: Combined Agg. Gradation	AASHTO T30	150 tons (140 Mg)	1 per Sublot	From Haul Vehicle at Plant	Random AASHTO T168
HMA Patching Mixture: Maximum Theo. Specific Gravity	AASHTO T209	150 tons (140 Mg)	1 per Sublot	From Haul Vehicle at Plant	Random AASHTO T168
HMA Patching Mixture: In-place Density	ASTM D2950 or AASHTO TP68	100 sq. feet. (10 sq. meter) per each Patch Area	1 per Sublot	From Compacted HMA Patch	Random ASTM D2950, AASHTO TP68

F. Quality Control Testing of HMA Lots.

The Contractor's QC personnel will perform Quality Control testing at both the HMA production facility and at the site of HMA field placement to ensure that the production and placement processes are providing work conforming to the contract requirements. The Engineer shall be provided the opportunity to monitor and witness all QC testing of HMA. All QC testing of HMA Lots shall be in accordance with the AASHTO, ASTM, NETTCP, or Department test methods specified in Table 450.10 and the procedures outlined below.

Table 450.10 - Minimum Quality Control Sampling & Testing of HMA Lots

Quality Characteristic	Test Method(s)	Sublot Size	Minimum Test Frequency	Point of Sampling	Sampling Method
PG Asphalt Binder Grading	AASHTO M320	Per Supplier QC Plan or 24,000 tons (22,000 Mg) of HMA per Subsection 450.65F(1)	See Subsection 450.65F(1)	See Subsection 450.65F(1)	Random AASHTO T40
Aggregate Gradation	AASHTO T27	Per QC Plan	Per QC Plan	At HMA Plant Per QC Plan	Random AASHTO T2
PG Asphalt Binder Content	AASHTO T164 or AASHTO T308	600 tons (550 Mg)	1 per Sublot(1)	From Haul Vehicle at Plant	Random AASHTO T168
Combined Aggregate Gradation	AASHTO T30	600 tons (550 Mg)	1 per Sublot(1)	From Haul Vehicle at Plant	Random AASHTO T168
Maximum Theo. Specific Gravity	AASHTO T209	600 tons (550 Mg)	1 per Sublot(1)	From Haul Vehicle at Plant	Random AASHTO T168
Bulk Specific Gravity	AASHTO T166 (SSD Method)	600 tons (550 Mg)	1 per Sublot(1)	From Haul Vehicle at Plant	Random AASHTO T168
Volumetrics: Air Voids, VMA, VFA	AASHTO T245	600 tons (550 Mg)	1 per Sublot(1)	From Haul Vehicle at Plant	Random AASHTO T168
In-place HMA Mat Density (Density Gauge)	ASTM D2950 or AASHTO TP68	150 tons (140 Mg)	1 per Sublot(1)	From Compacted HMA Course	Selective & Random ASTM D2950, AASHTO TP68
In-place HMA Mat Density (Cores)	AASHTO T230 AASHTO T166 AASHTO T269	600 tons (550 Mg)	1 per Sublot(1)	From Compacted HMA Course	Random AASHTO T269
Thickness	AASHTO T269	600 tons (550 Mg)	1 per Sublot(1)	From Compacted HMA	Random AASHTO T269
Transverse Joint Density	ASTM D2950 or AASHTO TP68	Each Joint	1 per Sublot(1)	At Finished Joint	Random ASTM D2950, AASHTO TP68
Longitudinal Joint Density	ASTM D2950 or AASHTO TP68	500 feet (150 meters) per Joint	1 per Sublot(1)	At Finished Joint	Random ASTM D2950, AASHTO TP68
Ride Quality (IRI)	AASHTO PP52 Per Subsection 450.65F(11)	0.1 miles (160 meters) per each Wheel Path	3 Runs per Sublot	Each Pavement Course Per Subsection 450.65F(11)	Random Per Subsection 450.65F(11)
Wheel Path Deviations	10 foot (3 meter) standard straightedge	500 feet (150 meters) per each Wheel Path	1 per Sublot(1)	Each Pavement Course Per Subsection 450.65F(12)	Random Per QC Plan

(1) In the event that the total daily HMA production is less than one Sublot, a minimum of one random QC sample shall be obtained for the day's production.

(1) PG Asphalt Binder Grading.

QC testing of PG Asphalt Binder shall be performed by the PGAB Supplier in accordance with AASHTO R26 and the Supplier's approved PGAB Quality Control Plan. The Contractor shall submit to the Engineer a Supplier's Certificate of Compliance (COC) along with copies of the certified AASHTO M320 test results for each Supplier Lot of PGAB from which the HMA Producer's PGAB was obtained.

If the Contractor modifies the PGAB at the HMA production facility through blending or introduction of an asphalt binder modifier, the Contractor (i.e. HMA Producer) shall assume responsibility as the PGAB Supplier per AASHTO R26. In such case, the Contractor shall obtain and test a minimum of one random sample of the modified PGAB for each 24,000 ton (22,000 Mg) HMA Sublot, as defined in Table 450.10, to determine conformance with AASHTO M320. A minimum of two 1-quart (1 Liter) containers of PGAB shall be obtained for each PGAB sample in accordance with AASHTO T40. All QC samples shall be split prior to testing and the un-tested portion of the sample shall be retained for a minimum of 30 days.

For HMA Category A Lots incorporating greater than 25% RAP or greater in the job-mix formula, the Contractor shall perform full asphalt binder grade testing on a minimum of one random sample from the Control Strip and from each Sublot as specified in Table 450.10 during HMA Lot production. The QC testing shall be performed on samples of asphalt binder recovered from the RAP (by Abson recovery) blended in the appropriate proportion with samples of the virgin PGAB to determine conformance with AASHTO M320. The PG Asphalt Binder Grade testing results shall be within ± 2ºC of the specified PGAB grade for the HMA pavement course mixture.

(2) Aggregate Gradation.

The virgin aggregates utilized in each HMA Lot shall be tested for Gradation in accordance with AASHTO T27. The Sublot size and minimum frequency of QC testing for Aggregate Gradation shall be as specified in the Contractor's approved QC Plan. Aggregate samples shall be obtained at the HMA plant from aggregate bins or stockpiles in accordance with AASHTO T2.

(3) PG Asphalt Binder Content.

Each HMA Lot produced and placed shall be tested for PG Asphalt Binder Content in accordance with either AASHTO T164 or T308. When AASHTO T164 is used, the test results shall be reported prior to ash correction. The Sublot size and minimum frequency of QC testing for PG Asphalt Binder Content shall be as specified in Table 450.10. Each material sample for PG Asphalt Binder Content shall be obtained at the HMA plant from a randomly selected quadrant from the haul vehicle in accordance with ASTM D3665 and AASHTO T168.

(4) Combined Aggregate Gradation.

Each HMA Lot produced and placed shall be tested for Combined Aggregate Gradation in accordance with AASHTO T30. The Sublot size and minimum frequency of QC testing for Combined Aggregate Gradation shall be as specified in Table 450.10. Each material sample for Combined Aggregate Gradation shall be obtained at the HMA plant from a randomly selected quadrant from the haul vehicle in accordance with ASTM D3665 and AASHTO T168.

The QC test results of Combined Aggregate Gradation must be plotted on Control Charts with Action Limits. Recommended Action Limits are provided in Table 450.11, however, the Action Limits to be used for each HMA Lot shall be as specified in the Contractor's approved QC Plan. If the QC test results for an individual Sublot fall outside of the established Action Limits, the Contractor shall evaluate the HMA production process and determine any adjustments necessary to bring the Combined Aggregate Gradation back within the Action Limits. If the subsequent Sublot test result falls outside of the Action Limits, the Contractor shall suspend Lot production until it can be demonstrated that the HMA mixture can be produced within the Action Limits. The Contractor's QC personnel shall document all action(s) taken to bring the HMA production process into control.

Table 450.11 - Recommended Action limits for Combined Aggregate Gradation

Sieve Size	Action Limit
Passing No. 4 Sieve (4.75mm) and larger sieve sizes	JMF Target +/-6 percent
Passing No. 8 sieves (2.36mm)	JMF Target +/-5 percent
Passing No. 16 (1.18mm) to No. 50 (300µm) sieves (inclusive)	JMF Target +/-3 percent
Passing No. 100(150µm) sieve	JMF Target +/-2 percent
Passing No. 200(75µm) sieve	JMF Target +/-1 percent

(5) Maximum Theoretical Specific Gravity.

Each HMA Lot produced and placed shall be tested for Maximum Theoretical Specific Gravity in accordance with AASHTO T209. The Sublot size and minimum frequency of QC testing for Maximum Theoretical Specific Gravity shall be as specified in Table 450.10. Each material sample for Maximum Theoretical Specific Gravity shall be obtained at the HMA plant from a randomly selected quadrant from the haul vehicle in accordance with ASTM D3665 and AASHTO T168.

(6) Bulk Specific Gravity.

Each HMA Lot produced and placed shall be tested for Bulk Specific Gravity in accordance with AASHTO T166 (SSD Method). The Sublot size and minimum frequency of QC testing for Bulk Specific Gravity shall be as specified in Table 450.10. Each material sample for Bulk Specific Gravity shall be obtained at the HMA plant from a randomly selected quadrant from the haul vehicle in accordance with ASTM D3665 and AASHTO T168.

(7) Volumetrics (Air Voids, VMA, VFA).

Each HMA Lot produced and placed shall be tested for Volumetrics (Air Voids, VMA, VFA) in accordance with AASHTO T245. The requirement for Volumetric testing of laboratory compacted specimens applies to HMA mixtures for all pavement courses, with the exception of Open Graded Friction Courses and Base Courses. The Sublot size and minimum frequency of QC testing for Volumetrics shall be as specified in Table 450.10. Each material sample for Volumetrics shall be obtained at the HMA plant from a randomly selected quadrant from the haul vehicle in accordance with ASTM D3665 and AASHTO T168.

(8) In-place HMA Mat Density.

Each HMA Lot produced and placed shall be tested for In-place Density using a density gauge or cores as specified below. The requirement for In-Place Density testing applies to all pavement courses, with the exception of Open Graded Friction Courses and Leveling Courses. The Sublot size and minimum frequency of random QC testing for In-place Density by either density gauge or core shall be as specified in Table 450.10.

(a) ***Testing In-Place Density by Density Gauge.*** Initial QC testing of In-Place Density during compaction of HMA pavement courses shall be performed selectively (or randomly when determined appropriate by QC personnel) using a density gauge in accordance with ASTM D2950 or AASHTO TP 68. QC testing of In-Place Density for all HMA bridge protective courses and bridge surface courses shall be performed randomly using a density gauge. Each random sampling and testing location for HMA bridge courses shall be established by determining a randomly selected tonnage and corresponding approximate longitudinal distance within the Sublot, along with a randomly selected offset distance in accordance with ASTM D3665. Additional selective QC sampling and testing within each Sublot of compacted HMA bridge

protective courses or bridge surface courses shall be as determined necessary by the Contractor's QC personnel and as specified in the Contractor's approved QC Plan.

(b) ***Testing In-Place Density by Cores.*** Final QC testing of In-Place Density of all applicable HMA pavement courses shall be performed using 6-inch (150 mm) diameter cores in accordance with AASHTO T230, T166, and T269. Cores shall not be obtained from bridge protective surface courses. In-Place Density shall be determined from each core by comparing the Bulk Specific Gravity of the core to the average Maximum Theoretical Specific Gravity for all HMA mixture Sublots produced for the pavement course on the same day's production. Each core location shall be established by determining a randomly selected tonnage and corresponding approximate longitudinal distance within the Sublot, along with a randomly selected offset distance in accordance with ASTM D3665. If the randomly determined sampling location coincides with one of the following conditions, the sampling location shall be relocated immediately beyond the boundary distance as indicated below for the specific condition:

1. Within 1 foot (300mm) from an edge of pavement course to be left unconfined upon project completion
2. Within 1 foot (300mm) of any longitudinal joint or transverse joint.
3. Within 3 feet (1 meter) of any drainage structure.

Core samples shall be obtained in accordance with AASHTO T230 prior to opening the pavement course to traffic. At the discretion of the Engineer, based on climactic or other conditions, obtaining of cores may be delayed for a period up to, but not to exceed, 48 hours. All cores shall be protected against damage and tested within 24 hours after they have been obtained. The Contractor shall fill all core holes, whether from QC sampling or Department Acceptance sampling, with fresh HMA mixture from the same Lot. The filled core holes shall be thoroughly compacted as outlined in the Contractor's approved QC Plan.

(9) Thickness.

Each HMA pavement course specified to be placed at a compacted thickness of 1 inch (25mm) or greater shall be tested for Thickness using cores, with the exception of the following courses:

1. Open Graded Friction Course.
2. Bridge Surface Course.
3. Bridge Protective Course.
4. Leveling Course.
5. In the absence of a Leveling Course, the first pavement course placed over existing pavement.

The aforementioned pavement courses are exempt only from determination of Thickness using cores and the corresponding statistical evaluation of Lot quality. The Contractor is still responsible for ensuring the minimum required thickness of these pavement courses using an appropriate sampling and testing protocol as outlined in the Contractor's approved QC Plan.

All sampling and testing for Thickness of the applicable pavement courses using cores shall be in accordance with AASHTO T269. The Sublot size and minimum frequency of random QC testing for Thickness shall be as specified in Table 450.10.

(10) Joint Density.

Each transverse joint and longitudinal joint formed during placement of a pavement course shall be tested for Joint Density using a density gauge in accordance with ASTM D2950. The requirement for Joint Density testing applies to all pavement courses, with the exception of Open Graded Friction Courses and Leveling Courses. The Sublot size and minimum frequency of random QC testing for Joint Density shall be as specified in Table 450.10.

Each random sampling and testing location shall be established by determining a randomly selected distance along the joint, along with a randomly selected offset distance within 1 foot (300 mm) of either side of the finished joint, in accordance with ASTM D3665. Additional selective QC sampling and testing of Joint Density within each Sublot of compacted HMA pavement courses or bridge protective surface courses shall be as determined necessary by the Field QCT and as specified in the Contractor's approved QC Plan.

(11) Ride Quality.

The finished surface of the pavement shall be uniform in appearance, free from irregularities in contour and texture and shall present a smooth riding surface. Ride Quality testing shall be performed for Quality Control on a periodic basis during construction of the HMA pavement courses specified below. QC testing shall be performed for HMA Category A Lots, at a minimum, within 24 hours after each 8 lane-miles (13 lane-kilometers) of an individual pavement course have been placed. QC testing of HMA Category B Lots shall be performed, at a minimum, every other paving day. In addition, the Contractor shall perform QC testing of the entire final pavement course placed upon completion.

(a) ***Pavement Courses Subject to Ride Quality Testing.*** For projects having a posted speed equal to or greater than 40 mph with HMA Lots falling under Lot Category A (Large Lots) or Category B (Small Lots), QC testing shall be performed with an inertial profiler to determine the Ride Quality of the following pavement courses:

- Friction Course (OGFC-P)
- Surface Course
- Intermediate Course (lift immediately beneath Surface Course only)
- Leveling Course (when placed immediately beneath Surface Course)
- Bridge Surface Course (when asphaltic bridge joints are used and when placed on the same contract with the mainline Surface Course)

At a minimum, the finished surface of these pavement courses will be tested for all mainline travel lanes, auxiliary lanes, ramps, and side road travel lanes. The Contractor may also elect to perform Ride Quality testing of the pavement courses beneath the courses indicated above in order to provide adequate Quality Control.

(b) ***Pavement Courses Excluded from Ride Quality Testing***

The following pavement courses and surfaces are specifically excluded from Ride Quality testing:

1. All exposed concrete bridge decks and any Bridge Surface Course without asphaltic bridge joints (including 15 feet (5 meters) before the approach joint and 15 feet (5 meters) after the departure joint).
2. Mainline pavement courses less than one half mile (800 meters) in total length (excluding bridge lengths).
3. Side road pavement courses less than one Sublot (0.1 mile (160 meters)) in total length.
4. Single resurfacing pavement courses placed in one lift at a total plan (compacted) thickness less than 1.50 inches (40 millimeters).
5. Pavement courses on horizontal curves having a centerline radius of curvature of 500 feet (150 meters) or less, including the length of pavement within the super-elevation transition of such curves.
6. Pavement courses for shoulders.
7. Pavement segments with manholes or catch basins in the travel lane (the Ride Quality testing data for such pavement segments shall be excluded, including 15 feet (5 meters) before and after these manholes or catch basins).

(c) ***Inertial Profiler Equipment Requirements.*** All inertial profilers used for Contractor QC testing shall conform to the equipment specifications contained in AASHTO PP50 and ASTM E950. The inertial profiler shall be equipped with a system of transducers (height sensor, accelerometer, distance sensor) to measure the longitudinal pavement profile. An automated triggering system shall be provided that detects a reference mark to start, stop, and event mark the data collection process. The profiler equipment shall include an onboard computer system capable of storing all profile measurement data, calculating the real time International Roughness Index (IRI) per ASTM E1926 (independent of speed), and displaying profile plots.

(d) ***Certification and Correlation of Inertial Profilers.*** All inertial profilers used for Contractor QC testing must be certified for precision and accuracy in accordance with the requirements of AASHTO PP51. In addition, all Contractor QC profilers must be correlated against the Department's reference profiling device in accordance with the Department's correlation procedures. The certification and correlation of all profilers shall be conducted at the Profiler Correlation Center in New Bedford, MA established by the University of Massachusetts at Dartmouth. The certification and initial correlation of the Contractor's inertial profiler shall be completed prior to the start of Ride Quality testing on the project. After the initial correlation is successfully completed, the same inertial profiler can be used on any Department project without re-correlation for the remainder of the construction season. Equipment that does not pass the Department's correlation procedure shall not be used. The Contractor's use of inertial profiler equipment that has not been successfully correlated is sufficient grounds for withholding payment for QC testing of Ride Quality. The Contractor's inertial profiler equipment may be required to undergo re-correlation at any time during the construction season if significant variations are found within the Contractor's QC test data or between the QC test data and the Department's Acceptance test data.

(e) ***Ride Quality Testing Procedures.*** Ride Quality testing shall be performed in accordance with the procedures outlined in AASHTO PP52, as clarified or amended herein.

The Ride Quality will be measured for each wheel path [a wheel path is defined as 3 feet (1 meter) from and parallel to each longitudinal edge of the lane to be measured]. Each wheel path will be divided into 0.1 mile (160 meters) Sublots starting at the project limits in the direction of traffic. Partial Sublots may result at either end of the project or as a result of interruptions of the continuous pavement surface (i.e. bridge approaches, railroad crossing, cessation of daily paving operations, etc.).

Just prior to testing, the Contractor shall sweep the pavement and remove all foreign objects or materials on the pavement course surface. Testing will begin 15 feet (5 meters) after the transverse approach joint and end 15 feet (5 meters) before the transverse departure joint. A minimum of three and up to a maximum of five test runs will be performed on each wheel path. The final test result for each Sublot will be the average of the three best test runs.

(f) ***Data Format and Reporting Requirements.*** All Ride Quality QC testing data shall be collected and saved in electronic format in an ASCII data file. A copy of the raw data file shall be provided to the Engineer on site immediately following testing of completed Sublots. A longitudinal profile shall be determined for all Sublots tested and an average IRI value shall be determined and reported for each Sublot (i.e. each 0.1 mile (160 meters) segment of each wheel path). The Contractor shall summarize the results for all Sublots, by corresponding Ride Quality Lot, in an electronic spreadsheet file (MS Excel) consistent with the format of the Department's QA Spreadsheets. The summary spreadsheet of QC testing data shall be submitted to the Department, electronically and in hardcopy, within two days after the testing is completed.

(g) ***Ride Quality Monitoring & Corrective Action.*** The Contractor shall evaluate and monitor the test data for each pavement course requiring Ride Quality testing for conformance with the applicable Quality Limits specified in Table 450.19. If the running Quality Level for all Sublots placed and tested falls below the Suspension Quality Level (70 PWL), the Contractor shall suspend further placement of the corresponding pavement course and evaluate the Sublots placed for appropriate corrective action. If the running Mean IRI of all Sublots placed and tested for the pavement course immediately below the final course is greater than the Action Limits specified in Table 450.12, corrective action will be required prior to placement of the final pavement course.

When Ride Quality correction is required, the Contractor shall use one or more of the following corrective methods:

1. Removal and replacement of the entire pavement course.
2. Partial depth removal of the pavement course by milling and placement of new pavement course(s) of the same mixture type.
3. Overlaying (not patching) with the specified pavement course.
4. Diamond grinding or use of other surface profiling devices.

The corrective method(s) chosen by the Contractor shall be subject to the approval of the Department and shall be performed at the Contractor's expense. The Contractor shall retest any Sublots where corrections are made and provide the Department with a copy of the raw data file, the profile plot, and the IRI summary spreadsheet data for the corrected Sublots.

Table 450.12 - Action Limits for Pavement Course Below Final Pavement Course

Posted Speed Limit(1)	**Target IRI**	**Maximum Mean IRI of All Sublots Tested**
Greater than or equal to 55 mph (90 km/hr)	60 in/mile (0.95 m/km)	≤ 85 in/mile (1.34 m/km)
40 mph (65 km/hr) to 55 mph (90 km/hr)	80 in/mile (1.26 m/km)	≤ 105 in/mile (1.66 m/km)
Less than 40 mph (65km/hr)	Not subject to Ride Quality testing	N/A

(1) Note that projects with posted speed limits that fall into more than one of the Posted Speed Limit ranges above will be divided into multiple Lots and evaluated separately.

450.66 HMA Mix Design Verification and Control Strip Requirements.

For all pavement courses with HMA Lots falling under Lot Category A (Large Lots), the HMA mix design Verification and Control Strip procedures outlined below shall apply.

A. Laboratory Verification of HMA Mix Design.

The Contractor shall develop and submit a Laboratory Trial Mix Formula (LTMF) for each HMA mixture type, which is to be proposed as a Job Mix Formula, a minimum of forty-five (45) days prior to the start of HMA production. The Contractor shall not proceed to HMA production for the Control Strip as outlined below until the LTMF is verified by the Department.

B. HMA Control Strip.

The Contractor shall produce and place a Control Strip Lot for all HMA pavement courses, with the exception of Leveling Courses, on the first day of HMA production. The Control Strip will be used to verify that the HMA can be produced per the LTMF, to establish compaction patterns, and to verify that the equipment and processes for lay-down and compaction are capable of providing the HMA pavement course in conformance with these specifications. The Control Strip Lot shall consist of a minimum of 600 tons (550 Mg) of HMA, but not more than 1,800 tons (1,650 Mg). Each Control Strip will be divided into three (3) equal Sublots. The Contractor and the Department will both perform inspection, sampling, and testing on the Control Strip and evaluate the corresponding data as outlined below.

(1) Control Strip Inspection.

The Contractor's QC personnel shall perform inspection of each Control Strip Sublot at both the HMA production facility and at the site of HMA field placement. The specific items to be inspected for the Control Strip shall include the four primary inspection components (Equipment, Materials, Environmental Conditions, Workmanship) in accordance with the requirements of Table 450.8a, Table 450.8b and as specified in the Contractor's approved QC Plan. The Department will also inspect each Control Strip Sublot for the inspection components of Materials and Workmanship.

(2) Control Strip Sampling and Testing.

The Contractor and the Department shall independently sample and test the Control Strip Lot for the Quality Characteristics identified in Table 450.13. The Contractor and the Department shall each sample and test each Sublot produced and placed. Each Contractor QC sample and each Agency Acceptance sample shall be randomly obtained from each Sublot in accordance with ASTM D3665 and the prescribed sampling protocols for each Quality Characteristic as outlined in Subsection 450.65F. Split samples shall be retained for each Sublot by both the Contractor and the Department in accordance with Subsection 450.65D.

(3) Evaluation of Control Strip Inspection Data.

The Contractor and the Department shall each evaluate their respective Control Strip inspection data against the requirements for Materials and Workmanship specified in Subsection 450.53 thru Subsection 450.58.

(4) Evaluation of Control Strip Sampling and Testing Data.

The Contractor and the Department shall each evaluate their respective individual Sublot test results against the Control Strip Quality Limits in Table 450.13. The Contractor and the Department shall also evaluate the Control Strip Lot Quality Level (PWL) using the Specification Limits in Table 450.13 for those Quality Characteristics subject to Quality Level Analysis. The Contractor's QC test data shall be combined with the Agency's Acceptance test data to determine the Lot Quality Level, provided that the QC data is Validated against the Acceptance data in accordance with Subsection 450.77. The Control Strip Lot Quality Level must be 70 PWL or greater.

Table 450.13 - Control Strip Quality Limits

Quality Characteristic	Target	Specification Limits		Engineering Limits		Acceptance Limit
		LSL	USL	LEL	UEL	
PG Asphalt Binder Grading	Per Binder Grade specified	N/A	N/A	Per AASHTO M320	Per AASHTO M320	N/A
PG Asphalt Binder Content	Per LTMF	Target - 0.3 %	Target + 0.3 %	Target - 0.4 %	Target + 0.4 %	≥ 70 PWL
Volumetrics: Air Voids	4 %	2.7 %	5.3 %	2 %	6 %	≥ 70 PWL
Combined Gradation: Passing #4 (4.75mm) and Larger Sieves	Per LTMF	N/A	N/A	Target - 7%	Target + 7%	N/A
Combined Gradation: Passing #8 (2.36mm) Sieve	Per LTMF	N/A	N/A	Target - 5%	Target + 5%	N/A
Combined Gradation: Passing #16 (1.18mm) to #50 (300um) Sieve	Per LTMF	N/A	N/A	Target - 4%	Target + 4%	N/A
Combined Gradation: Passing #100 (150um) Sieve	Per LTMF	N/A	N/A	Target - 3%	Target + 3%	N/A
Combined Gradation: Passing #200 (75um) Sieve	Per LTMF	N/A	N/A	Target - 1.5%	Target + 1.5%	N/A
In-Place HMA Mat Density (Cores)	95 % of G_{mm}	92.5 % of G_{mm}	97.5 % of G_{mm}	92 % of G_{mm}	98 % of G_{mm}	≥ 70 PWL
Thickness*: (All Courses 1 inch (25mm) or greater)	Per Plans	- 20 % of Target Thickness	+ 20 % of Target Thickness	- 30 % of Target Thickness	+ 30 % of Target Thickness	≥ 70 PWL
Ride Quality*: Greater than or equal to 55 mph (90 km/hr)	50 in/mile (0.79 m/km)	N/A	70 in/mile (1.10 m/km)	N/A	80 in/mile (1.26 m/km)	≥ 70 PWL
Ride Quality*: 40mph (65 km/hr) to 55 mph (90 km/hr)	70 in/mile (1.10 m/km)	N/A	100 in/mile (1.58 m/km)	N/A	110 in/mile (1.74 m/km)	>70 PWL

*To be evaluated for applicable pavement courses subject to testing per Subsection 450.65F. The Quality Limits for Ride in Table 450.13 shall only apply to Control Strips for the final pavement course (HMA Surface Course or Friction Course). For pavement courses below the final pavement course that are subject to Ride Quality testing, the Mean IRI for the Control Strip Sublots shall be less than or equal to the Maximum Mean IRI values in Table 450.12.

(5) Verification of Control Strip Lot and LTMF.

In order for a Control Strip Lot and corresponding LTMF to be Verified, the following criteria must be met:

a) All Attributes inspected for each Sublot must meet the specification requirements in Table 450.16.
b) All individual Sublot test results for the Quality Characteristics tested on the Control Strip must be within the Engineering Limits in Table 450.13.
c) If the evaluation of all inspection data and testing data for the Control Strip indicates that the individual Sublots are in conformance with the requirements outlined in Subsection 450.66 B paragraphs (3) and (4) above and the Lot Quality for each applicable Quality Characteristic in Table 450.13 is ≥ 70 PWL, the Control Strip Lot and LTMF shall be declared "Verified". In such event, the LTMF shall become the Job Mix Formula (JMF) for the Lot and the Contractor may proceed with production and placement of the first HMA Lot.
d) If the Control Strip is not Verified, the Contractor shall reassess the LTMF, the production process, and the placement process to determine the apparent cause(s) of nonconformance. The Contractor must submit proposed adjustment(s) to the LTMF and/or the production process and/or placement process. If adjustments to the LTMF are "major" (as defined in Table 1 of AASHTO R 42), the Contractor will be required to submit a new LTMF for laboratory verification by the Engineer per the requirements of Section 450.66A. If proposed adjustment(s) are accepted by the Engineer, the Contractor may proceed with a subsequent Control Strip.
e) If a 2nd or any subsequent Control Strip does not pass all of the inspection and testing requirements, the Contractor must submit proposed adjustment(s) to the LTMF and/or the production process and/or placement process,
f) If the computed PWL for any Quality Characteristic, with the exception of thickness, is < 60 PWL, the Control Strip Lot will be determined rejected and shall be removed. If the mean thickness of the Lot is determined to be greater than the target, it may remain in place, but payment will be based upon the HMA tonnage calculated at the target thickness.
g) For any Control Strip that is not Verified, the Contractor shall prepare a Corrective Action Plan for the nonconforming Control Strip Lot. The corrective method(s) proposed by the Contractor shall be subject to the approval of the Department and shall be performed at the Contractor's expense.

(6) Acceptance and Payment of Control Strips

(a) ***1st and 2nd Control Strip***

For each Control Strip Lot that has been Verified, payment shall be determined for each individual Quality Characteristic in accordance with the pay adjustment provisions of Subsection 450.92. If the Lot Quality Level for an individual Quality Characteristic is 90 PWL, payment for the Quality Characteristic shall be 100% of the Contractor's bid price for the pay item quantity placed on the Control Strip. If the Lot Quality Level for an individual Quality Characteristic is > 90 PWL, payment for the Quality Characteristic shall be an incentive amount determined in accordance with Subsection 450.92. If the Lot Quality Level for an individual Quality Characteristic is ≥ 60 PWL, but < 90 PWL, payment for the Quality Characteristic shall be a disincentive amount determined in accordance with Subsection 450.92. If the computed Quality Level for an individual Quality Characteristic is < 60 PWL, the Control Strip Lot will be determined rejected and removed in accordance with Subsection 450.66B(5) and shall receive no payment.

(b) *3rd Control Strip*

If a 3rd Control Strip Lot is placed and is Verified, payment shall be limited to a maximum of 85% of the Contractor's bid price for the entire pay item quantity placed on the Control Strip, regardless of the actual calculated Quality Level for the Lot. If a 3rd Control Strip Lot is placed and is not Verified, payment shall be limited to a maximum of 80% of the Contractor's bid price for the entire pay item quantity placed on the Control Strip, regardless of the actual calculated Quality Level for the Lot. If the computed Quality Level for an individual Quality Characteristic is < 60 PWL, the Control Strip Lot will be determined rejected and removed in accordance with Subsection 450.66B(5) and shall receive no payment.

(c) *4th or Subsequent Control Strip*

If a 4th or subsequent Control Strip Lot is placed and is Verified, payment shall be limited to a maximum of 75% of the Contractor's bid price for the entire pay item quantity placed on the Control Strip, regardless of the actual calculated Quality Level for the Lot. If a 4th or subsequent Control Strip Lot is placed and is not Verified, payment shall be limited to a maximum of 70% of the Contractor's bid price for the entire pay item quantity placed on the Control Strip, regardless of the actual calculated Quality Level for the Lot. If the computed Quality Level for an individual Quality Characteristic is < 60 PWL, the Control Strip Lot will be determined rejected and removed in accordance with Subsection 450.66B(5) and shall receive no payment.

450.67 Quality Control Documentation and Data Evaluation.

A. QC Inspection Documentation & Evaluation.

The Contractor shall document all QC inspection activity for each HMA Lot Category (Category A, B, or C) produced and placed. All inspection results shall be recorded within 24 hours of inspection on current NETTCP standard Inspection Report Forms (IRFs). The QC Manager shall evaluate inspection results in a timely manner to confirm that production and placement processes are in control. The Contractor shall submit hard copies of all IRFs to the Engineer at the completion of each Lot.

B. QC Sampling and Testing Documentation & Data Analysis.

The Contractor shall document all QC sampling and testing data for each HMA Lot Category (Category A, B, or C) produced and placed. All sampling and testing data shall be recorded within 24 hours of sampling and testing on current NETTCP standard Test Report Forms (TRFs). The QC Manager shall evaluate sampling and testing results in a timely manner, as further outlined below, to confirm that production and placement processes are in control. All QC testing data shall be entered into the Department's MS-Excel QA Data Spreadsheets via the internet (mhdqa.com) within two (2) days after completion of testing. The Contractor shall submit hard copies of all TRFs to the Engineer at the completion of each Lot.

(1) Control Charts.

For each HMA Category A Lot produced and placed, the Contractor shall use Control Charts as part of the QC system to assist in identifying assignable causes affecting the HMA production and placement processes. Control Charts shall be prepared for the Quality Characteristics subject to QC sampling and testing listed in Table 450.10. As a minimum, the Contractor shall plot all QC test results of each Lot on Control Charts for individual Sublot measurements or test values (Run Charts). It is also recommended practice for the Contractor to use Control Charts that plot Subgroups of data (e.g. X-Bar Charts, R Charts). The Contractor shall submit examples of the Control Charts to be used in the QC Plan. As a minimum, the Control Charts shall identify the Contract number, the Payment Item number, the Lot number, the Quality Characteristic, the Control Chart Target, the Upper and Lower Control Chart Limits, and Sublot or Subgroup numbers.

All Control Charts should be updated within 24 hours after the corresponding testing is completed and documented. Quality Control personnel should use the Control Chart data to monitor and adjust the production and placement processes or suspend operations as determined necessary. Control Charts for Quality Characteristics related to HMA production should be maintained at the HMA production facility. Control Charts for Quality Characteristics related to HMA field placement should be maintained at the project field site. Current Control Charts shall be posted in an accessible location. The Engineer shall be provided access to all Control Charts as part of the Department's monitoring of Contractor QC activity.

(2) Evaluation of Individual Sublot QC Test Results.

The Contractor shall evaluate the individual QC test results for each HMA Lot Category (Category A, B, or C) produced and placed. Each random QC test result shall be evaluated against the applicable Quality Limits within 24 hours of testing. For HMA Category A Lots and Category B Lots, each Sublot test value shall be within the Engineering Limits specified in Table 450.19. For HMA Category C Lots, each Sublot test value shall be within the Specifications Limits indicated in Table 450.19.

If the evaluation of the QC testing data indicates that an individual Sublot is not in conformance with the applicable Quality Limits for the particular HMA Lot Category, the Contractor shall isolate the Sublot and perform selective sampling followed by additional random sampling of the Sublot to quantify the actual quality of the Sublot.

(3) Evaluation of Lot Quality Level.

For HMA Category A Lots and Category B Lots, the Contractor shall use all random QC test results to continuously evaluate the running quality level and determine the percent within limits (PWL) for each Lot during production and placement. The PWL shall be determined through Quality Level Analysis (QLA) for each of the applicable Quality Characteristics listed in Table 450.19 using the corresponding Specification Limits therein. The Contractor shall perform a running QLA using random QC data only at a minimum after each 5 Sublots have been tested and shall plot the cumulative PWL after each 5 Sublot interval. The Engineer shall be provided access to all records documenting the running QLA for each Lot as part of the Department's monitoring of Contractor QC activity.

If the running QLA shows the PWL falling below the Acceptable Quality Level (AQL) of 90 PWL, the Contractor shall initiate appropriate adjustments to the production or placement process or initiate corrective action in accordance with procedures outlined in the approved QC Plan. If the PWL falls below the Suspension Quality Level (SQL) of 70 PWL, the Contractor shall suspend production and placement of the Lot. The Contractor shall prepare a plan of corrective action for any nonconforming Lot, as further outlined below. If significant adjustment to the JMF or the production or placement process is required, a new Lot will be established. After resuming production and placement, the PWL for the Lot must be back at or above the AQL of 90 PWL.

450.68 Corrective Action.

As part of the Contractor's Quality Control system, the Contractor shall implement corrective action for any part of a Lot that is determined by inspection or testing to not be in conformance with the quality requirements specified in Section 450. If the results of QC inspection identify nonconforming material or workmanship within one or more Sublots, or if the evaluation of the QC testing data indicates that any Sublot is not in conformance with the applicable Quality Limits for the particular HMA Lot Category, the Contractor shall isolate the Sublot(s) and perform additional inspection or testing to further assess the quality of the Sublot. Selective inspection or testing should be used to determine the limits of nonconformance, followed by random inspection or testing to quantify the actual quality of the nonconforming area.

Based on the results of additional inspection or testing, the Contractor shall prepare a plan of corrective action for the nonconforming Sublot(s). The Corrective action plan shall be submitted to and approved by the Engineer prior to initiating corrective action. All corrective action shall be performed at the Contractor's expense.

450.69 Quality Control Records System.

A. Quality Control Daily Diary.

The QC Manager should maintain a Quality Control Daily Diary (QC Daily Diary) to document all major activities or actions related to the Contractor's QC system. The QC Daily Diary serves as a summary record of key actions taken by QC personnel each day. Recommended Information which should be recorded in the QC Daily Diary includes:

- The day's weather or environmental conditions.
- A summary of production or placement activities completed.
- Any non-conforming material or workmanship identified.
- Any corrective actions recommended or taken by QC personnel.
- Discussions held with other Contractor personnel or Department personnel.
- Visitors to the production facility or field placement operation.

B. Quality Control Record Books.

The Contractor shall maintain one or more ringed binders referred to as "Quality Control Record Books" (QC Record Books) to store all required QC documents. Separate QC Record Books shall be kept at each HMA production facility and at the project field site. Either a separate QC Record Book shall be established for each HMA pavement course or the data for each pavement course may be included in a single QC Record Book provided the data is separated according to pavement course. QC data for each pavement course shall be organized into separate sections by Quality Characteristic and by Lot number.

QC documents to be stored in the QC Record Book(s) include:

- A signed copy of the current approved QC Plan.
- The original signed copies of all completed Inspection Report Forms.
- The original signed copies of all completed Random Sampling location forms.
- The original signed copies of all completed Test Report Forms.
- A current copy or printout of all Control Charts.
- A current copy or printout of all running QLA performed.
- Current summaries of all individual QC test results to date (by Lot & Sublot).
- Summary sheets of material quantities produced or placed (by Lot & Sublot).

Each required record shall be inserted into the corresponding QC Record Book within 24 hours after the document has been completed. All QC Record Books shall be maintained in a suitable location. The Engineer shall be provided access to all QC Record Books as part of the Department's monitoring of Contractor QC activity.

C. Quality Control Records Retention.

All Contractor QC records identified above shall be retained for a minimum of seven (7) years. The records shall be protected from damage or alteration. When requested by any State or Federal Agency for audit or similar purposes, the Contractor shall provide complete access to all QC records.

DEPARTMENT ACCEPTANCE

450.70 General.

The Department is responsible for performing all Acceptance activities and making the final acceptance determination for each HMA Lot produced and placed. The Department's Acceptance system will include monitoring the Contractor's QC activity, performing Acceptance inspection, sampling & testing, and determining the Quality and corresponding payment for each Lot. These activities will be performed for each HMA Lot Category (Lot Category A, B, and C) as outlined further below.

450.71 Acceptance System Approach.

A. Acceptance of Category A Lots.

The Engineer's acceptance determination for each HMA Category A Lot will be based on an evaluation of the Department's Acceptance inspection information and Acceptance testing data. The Engineer will perform Acceptance sampling and testing on a minimum of 25% of the Sublots produced and placed. Contractor QC test data will be included in the Department's acceptance determination for each Category A Lot provided the following requirements are met:

- Split Sample Correlation testing requirements are satisfied.
- The Contractor provides adequate Quality Control per the approved QC Plan.
- All QC test results included are from random samples.
- The QC test results are Validated against the Department's Acceptance test results.

B. Acceptance of Category B Lots.

The Engineer's acceptance determination for each HMA Category B Lot will also be based on an evaluation of the Department's Acceptance inspection information and Acceptance testing data. The Engineer will perform Acceptance sampling and testing on a minimum of 50% of the Sublots produced and placed, but not less than three (3) Sublots. Contractor QC test data will be included in the Department's acceptance determination for each Category B Lot provided the requirements outlined in paragraph A above are satisfied.

C. Acceptance of Category C Lots.

For all HMA Category C Lots, the Engineer's acceptance determination will be based only on the Department's Acceptance inspection information and Acceptance testing data. The Engineer will perform Acceptance sampling and testing on 100% of the Sublots produced and placed. Contractor QC test data will not be included in the Department's acceptance determination for Category C Lots.

450.72 Department Monitoring of Contractor Quality Control.

For projects with HMA Category A Lots or Category B Lots, the Department will monitor the Contractor's Quality Control system to confirm that QC activities are being performed for each Lot in reasonable compliance with the approved QC Plan. Department monitoring of the Contractor's QC system is not intended to evaluate the Quality of the Work. The Engineer will not perform the QC responsibilities of the Contractor or provide constant direction to the Contractor on how to perform Quality Control. The Engineer's monitoring of QC activity will include the following:

- Periodic visual observation of QC inspection, sampling, and testing.
- Reviewing QC documentation and records.
- Providing feedback based on monitoring findings.

The Engineer will document all findings (positive or negative) from any monitoring of the Contractor's QC system on standard Monitoring Report Forms (MRFs). Copies of all MRFs will be provided to the Contractor on a timely basis. When deficiencies in the Contractor's QC system are identified and documented by the Engineer, the Contractor shall take immediate action to address the deficiencies. If the Contractor fails to take appropriate action, the Contractor shall suspend production and placement of the corresponding Lot(s). The Department will withhold payment for the Contractor Quality Control Payment Item (Item No. 450.70) until the Contractor implements satisfactory corrective measures.

450.73 Acceptance Inspection.

The Engineer will perform Acceptance inspection of all work items addressed under Section 450 to ensure that all materials and completed work are in conformance with the contract requirements. Acceptance inspection is intended to visually assess the quality of each HMA Lot produced and placed and will address only the inspection components of Materials and Workmanship in support of the Department's final acceptance determination.

All Acceptance inspection activity by the Department will be performed independent of the Contractor's QC inspection at both the HMA production facility and at the site of HMA field placement. The Engineer will document the results and findings of Acceptance inspection on NETTCP Inspection Report Forms (IRFs). The Engineer will furnish a copy of all Department Acceptance inspection results to the Contractor within five (5) days following the inspection.

A. Acceptance Inspection of Prepared Underlying Surface.

The Department will perform Acceptance inspection of the prepared underlying surface prior to placement of HMA. The items to be inspected and minimum frequency of inspection will be in accordance with the requirements outlined in Table 450.14 and Table 450.15.

Table 450.14 - Department Acceptance Inspection of HMA Patching

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Materials	Mixture Type + PG Binder Grade (Correct Type)	1 per Day	HMA Production Facility	Visual Check + Manufacturer COC
	Rubberized Asphalt Sealant (Correct Type)	1 per Day	At Paving Site	Check Manufacturer COC
Workmanship	Sawcut Limit Vertical Face	25% of Patched Areas	Sawcut Limits	Visual Check
	Rubberized Asphalt Sealant Application Rate	25% of Patched Areas	Sawcut Limits	Visual Check + Check Measurement
	Cross-Slope & Profile	25% of Patched Areas	Compacted HMA	Check Measurement

Table 450.15 - Department Acceptance Inspection of Tack Coat

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Materials	Asphalt Emulsion (Correct Type)	1 per Day	At Paving Site	Check Manufacturer COC
Workmanship	Asphalt Emulsion Application Rate	Once per 5,000 lane-ft (1,500 lane-m)	Tacked Surface + Tack Distributor System	Visual Check + Check Measurement

B. Acceptance Inspection of HMA Lots.

The Department will perform Acceptance inspection at both the HMA production facility and at the site of HMA field placement. For purposes of Acceptance inspection, the total quantity of each HMA pavement course produced and placed during the same construction season will constitute a Lot. Each in-place HMA Lot will be divided into 500 lane-feet (150 lane-meters) Sublots. The items to be inspected and minimum frequency of inspection will be in accordance with the requirements outlined in Table 450.16.

(1) Wheel Path Deviations.

Each HMA Lot produced and placed will be inspected by the Engineer for Wheel Path Deviations (high points or low points) using a 10 foot (3 meter) standard straightedge in accordance with the procedures outlined in Subsection 450.64B. Acceptance inspection for Wheel Path Deviations applies to all pavement courses (including bridge protective courses and bridge surface courses). The finished surface of each required pavement course will be inspected for all mainline travel lanes, auxiliary lanes, ramps, and side road travel lanes. The Sublot size and minimum frequency of Acceptance inspection for Wheel Path Deviations will be as specified in Table 450.16.

Table 450.16 - Department Acceptance Inspection of HMA Lots

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Materials	HMA Mixture Type, Aggregates & PG Binder (Correct Type)	1 per Day	HMA Production Facility	Visual Check + Manufacturer COC
	Rubberized Asphalt Sealant (Correct Type)	1 per Day	At Paving Site	Check Manufacturer COC
Workmanship	Joint Location & Alignment	50% of Sublots, Once per Joint	At Finished Joint	Visual Check
	Sawcut Joint Vertical Face	50% of Sublots, Once per Joint	Joint Vertical Face	Visual Check
	Rubberized Asphalt Sealant Application Rate	50% of Sublots, Once per Joint	Joint Vertical Face	Visual Check + Check Measurement
	Physical Segregation	50% of Sublots, Once per Lane	Compacted HMA	Visual Check
	Cross-Slope	50% of Sublots, Once per Lane	Compacted HMA	Check Measurement
	Joint Tightness	50% of Sublots, Once per Joint	Compacted HMA	Visual Check
	Joint Surface Deviations	50% of Sublots, Once per Joint	At Finished Joint	10 foot (3 meter) standard straightedge
	Wheel Path Deviations	50% of Sublots, per Wheel Path	Wheel Path	10 foot (3 meter) standard straightedge

450.74 Acceptance Sampling & Testing.

A. Random Sampling.

The Department will utilize stratified random sampling to determine the overall quality of each HMA Lot produced and placed. Random Acceptance sample locations will be determined by the Engineer in accordance with ASTM D 3665 or by electronic random number generator, as presented by the NETTCP. All random Acceptance sample locations will be documented on NETTCP Standard Test Report Form D3665.

The Contractor shall furnish the Engineer with approved containers for all Acceptance samples. The Engineer will obtain all random Acceptance samples independent of the Contractor's QC samples at the frequencies outlined below.

(1) Sampling HMA Category A Lots.

The Engineer will obtain Acceptance samples from a minimum of 25% of all Sublots in each HMA Category A Lot for all Quality Characteristics specified in Table 450.17, other than PG Asphalt Binder Grading and Ride Quality. Acceptance samples For PG Asphalt Binder Grading and Ride Quality will be obtained from each Sublot as defined in Table 450.17.

(2) Sampling HMA Category B Lots.

The Engineer will obtain Acceptance samples from a minimum of 50% of all Sublots, but not less than three (3) Sublots, in each HMA Category B Lot for all Quality Characteristics specified in Table 450.17, other than PG Asphalt Binder Grading and Ride Quality. Acceptance samples For PG Asphalt Binder Grading and Ride Quality will be obtained from each Sublot as defined in Table 450.17.

(3) Sampling HMA Category C Lots.

The Engineer will obtain Acceptance samples from 100% of all Sublots in each HMA Category C Lot for all Quality Characteristics specified in Table 450.17, other than Ride Quality. Acceptance sampling and testing for Ride Quality will not be performed on Category C Lots.

B. Selective Sampling.

The Department will utilize selective sampling (i.e. non-random samples) as needed to provide supplemental information to assist in quantifying the quality of apparent nonconforming material. When the results of acceptance inspection or random sampling and testing identify material which is not in conformance with the applicable Quality Limits for the particular HMA Lot Category, the Engineer will isolate the corresponding Sublot(s) and perform selective sampling to further assess the quality of the Sublot. Selective inspection or testing will be used to determine the limits of nonconformance, followed by random inspection or testing to quantify the actual quality of the nonconforming area. The test results of selective Acceptance samples will not be combined with random Acceptance sample data in the determination of Lot acceptance using Quality Level Analysis as outlined in Subsection 450.78.

C. Contractor Assistance in Obtaining Acceptance Samples.

The Engineer will obtain all material samples for Acceptance testing by the Department. When requested by the Department, the Contractor shall assist the Engineer in obtaining Acceptance samples in accordance with the following requirements:

- The Acceptance sample location and time will be randomly selected by the Engineer and provided to the Contractor immediately prior to sampling.
- The Contractor's qualified QC personnel will only provide the physical labor to assist the Engineer in obtaining the Acceptance sample.
- The Engineer will be present to direct and monitor the taking of the sample.
- The Engineer will take immediate possession of the Acceptance sample.

Contractor assistance may be requested in obtaining Acceptance samples for PG Asphalt Binder Grading and for In-Place Density and Thickness (HMA cores). The Contractor shall provide adequate traffic control for the Department to obtain cores, regardless of whether the Contractor assists the Engineer in obtaining the Acceptance core samples.

D. Acceptance Sample Identification System.

The Department will use a standard system for the identification of all Acceptance samples. All PG Asphalt Binder samples, HMA loose mixture samples, and core samples will be labeled by the Engineer with the minimum information indicated under Subsection 450.65C. Acceptance sampling data for Ride Quality and Wheel Path Deviations will be identified by the Engineer in accordance with the Department's Standard Operating Procedures (SOPs).

E. Retention of Split Samples.

Qualified Department personnel will obtain all material samples (PGAB samples, HMA loose mix samples, and cores) for Acceptance testing. The Department will retain split samples from each PGAB sample and HMA loose mix sample and provide a split sample to the Contractor if requested. The Department will retain the original core samples after testing to serve as "split samples" and protect them from damage. All split samples will be stored for a period of (30) days, or until tested. These split samples will be utilized if necessary, in the Dispute Resolution process. If mutually agreed upon by the Department and the Contractor, the retained split samples may be discarded prior to the required thirty (30) days.

F. Acceptance Testing of HMA Lots.

The Department will perform Acceptance testing using the random samples obtained in accordance with Subsection 450.74A from the HMA production facility and at the site of HMA field placement. The specific Quality Characteristics subject to Department Acceptance testing are identified in Table 450.17. All Acceptance testing of HMA Lots will be performed by the Engineer in accordance with the AASHTO, ASTM, NETTCP, or Department test methods specified in Table 450.17 and the procedures outlined below. The Engineer will furnish a copy of all Department Acceptance test results/data to the Contractor within five (5) days following completion of testing.

(1) PG Asphalt Binder Grading.

The Department will review the Supplier's Certificate of Compliance (COC) and corresponding certified AASHTO M320 test results submitted by the Contractor for each Supplier Lot of PGAB from which the HMA Producer's PGAB was obtained. The Engineer will also obtain and test a minimum of one random Acceptance sample of PGAB for each 12,000 ton (11,000 Mg) HMA Sublot, as defined in Table 450.17, to determine conformance with AASHTO M320. A minimum of two 1-quart (1-Liter) containers of PGAB will be obtained for each Acceptance sample from the HMA Producer's tanks in accordance with AASHTO T40. All PGAB Acceptance samples will be split prior to testing and the un-tested portion of the sample will be retained for a minimum of 30 days.

(2) PG Asphalt Binder Content.

The Engineer will test each HMA Lot produced and placed for PG Asphalt Binder Content in accordance with either AASHTO T164 or T308. When AASHTO T164 is used, the test results will be reported prior to ash correction. The Sublot size and minimum frequency of Acceptance testing for PG Asphalt Binder Content will be as specified in Table 450.17. Each material sample for PG Asphalt Binder Content will be obtained at the HMA plant from a randomly selected quadrant from the haul vehicle in accordance with ASTM D3665 and AASHTO T168.

Table 450.17 - Department Acceptance Sampling and Testing of HMA Lots

Quality Characteristic	Test Method(s)	Sublot Size	Minimum Test Frequency	Point of Sampling	Sampling Method
PG Asphalt Binder Grading	AASHTO M320	12,000 tons (11,000 Mg) of HMA using same PG Grade	1 per Sublot	From Tank Valve at HMA Plant	Random AASHTO T40
PG Asphalt Binder Content	AASHTO T164 or AASHTO T308	600 tons (550 Mg)	1 per Sublot sampled per Subsection 450.74A(1)	From Haul Vehicle at HMA Plant	Random AASHTO T168
Volumetrics: Air Voids	AASHTO T245	600 tons (550 Mg)	1 per Sublot sampled per Subsection 450.74A(1)	From Haul Vehicle at HMA Plant	Random AASHTO T168
In-place HMA Mat Density (Cores)	AASHTO T269 AASHTO T230 AASHTO T209 AASHTO T166	600 tons (550 Mg)	1 per Sublot sampled per Subsection 450.74A(1)	From Compacted HMA Course	Random AASHTO T269
In-place HMA Mat Density (Bridge Courses)	ASTM D2950 or AASHTO TP68	150 tons (140 Mg)	1 per Sublot sampled per Subsection 450.74A	From Compacted HMA Course	Random ASTM D2950 or AASHTO TP68
Thickness	AASHTO T269	600 tons (550 Mg)	1 per Sublot sampled per Subsection 450.74A(1)	From Compacted HMA Course	Random AASHTO T269
Ride Quality (IRI)	AASHTO PP52 per Subsection 450.65F(11)	0.1 miles (160 meters) per each Wheel Path	1 Per Sublot	Each Pavement Course per Subsection 450.65F(11)	Random per Subsection 450.65F(11)

(1) In the event that the total daily HMA production is less than one Sublot but greater than 150 tons (140 Mg), a minimum of one random Acceptance sample shall be obtained for the day's production.

(3) Volumetrics (Air Voids).

The Engineer will test each HMA Lot produced and placed for Volumetrics (Air Voids) in accordance with AASHTO T245. The requirement for Volumetric testing of laboratory compacted specimens applies to HMA mixtures for all pavement courses, with the exception of Open Graded Friction Courses and Base Courses. The Sublot size and minimum frequency of Acceptance testing for Volumetrics will be as specified in Table 450.17. Each material sample for Volumetrics will be obtained at the HMA plant from a randomly selected quadrant from the haul vehicle in accordance with ASTM D3665 and AASHTO T168.

(4) In-Place HMA Mat Density.

The Engineer will test each HMA Lot produced and placed for In-place HMA Mat Density. The requirement for In-Place Density testing applies to all pavement courses, with the exception of Open Graded Friction Courses and Leveling Courses, as outlined below.

(a) Testing In-Place Density by Cores. Acceptance testing of HMA pavement courses (other than bridge courses) for In-place Density will be performed using cores in accordance with the procedures outlined in Subsection 450.65F(8)(b). The Sublot size and minimum frequency of Acceptance testing for In-place Density of HMA pavement courses by core will be as specified in Table 450.17.

(b) Testing In-Place Density by Density Gauge. **Acceptance testing of all HMA Bridge Protective Courses and Bridge Surface Courses for In-place Density will be performed using a density gauge in accordance with the procedures outlined in Subsection 450.65F(8)(a). The Sublot size and minimum frequency of Acceptance testing for In-place Density of HMA bridge courses by density gauge will be as specified in Table 450.17.**

(5) Thickness.

Each HMA pavement course specified to be placed at a compacted thickness of 1 inch (25mm) or greater, with the exception of the HMA pavement courses identified in Subsection 450.65F(9), will be tested by the Engineer for Thickness using cores. Acceptance sampling and testing for Thickness of the applicable pavement courses shall be in accordance with AASHTO T269. The Sublot size and minimum frequency of Acceptance testing for Thickness will be as specified in Table 450.17.

(6) Ride Quality.

Department Acceptance testing for Ride Quality will be required for all projects having a posted speed equal to or greater than 40 mph (65 km/hr) with HMA Lots falling under Lot Category A or Category B. The Engineer will perform Ride Quality testing on the final HMA pavement course placed (either Surface Course or OGFC-P, when specified) for all mainline travel lanes, auxiliary lanes, ramps, and side road travel lanes using an inertial profiler in accordance with the procedures outlined in Subsection 450.65F(11). Pavement courses and surfaces that are specifically excluded from Acceptance testing for Ride Quality are as specified in Subsection 450.65F(11)(b). The Sublot size and minimum frequency of Acceptance testing for Ride Quality will be as specified in Table 450.17.

The inertial profiler equipment used to perform Acceptance testing will be certified and correlated by the Department in accordance with the requirements and procedures outlined in Subsection 450.65F(11). The Department Acceptance data and Contractor QC data will be correlated and normalized using statistical procedures. The normalization of data will be based on the measurement difference/bias from the Department Reference Profiling Device determined during the device correlation conducted at the Profiling Center by UMass Dartmouth. The Department will provide software and procedures to perform the data normalization. The normalized Acceptance Ride Quality data and QC Ride Quality data will be used to determine the quality level (PWL) and corresponding pay for each Lot.

450.75 Split Sample Correlation.

Split Sample Correlation is an important part of the Department acceptance system for HMA Category A Lots and Category B Lots. Split Sample Correlation shall be performed when Validated Contractor QC test data is to be included in the acceptance determination. The purpose of Split Sample Correlation testing is to identify and eliminate any discrepancies in testing procedures or equipment that could result in significant differences between the Contractor's QC testing results and the Engineer's Acceptance testing results.

Either prior to or on the first day of production and placement of any HMA Category A Lot or Category B Lot, the Contractor and the Department will conduct Split Sample Correlation. The Engineer or the Contractor may also request that Split Sample Correlation be performed at any time during HMA Lot production and placement. Department IA personnel may also test a split of the Correlation samples.

Split Sample Correlation will be performed on split material samples for those Quality Characteristics identified in Table 450.18. Correlation samples for HMA mixture testing shall be either laboratory prepared specimens or plant produced HMA specimens. Samples for HMA Category A Lots may be obtained from the Control Strip Lot. Correlation testing of the Contractor's QC ride quality testing equipment and the Department's Acceptance ride quality testing equipment will be performed in accordance with Subsection 450.65F(11)(c).

Table 450.18 Split Sample Correlation Allowable Differences

Quality Characteristic	Allowable Difference Between Contractor and Department Split Samples
Maximum Theoretical Specific Gravity (Gmm)	+/- 0.020
Bulk Specific Gravity (Gmb)	+/- 0.030
PG Asphalt Binder Content	+/- 0.4%
Volumetrics - Air Voids	+/- 1.4%
In-Place HMA Mat Density	+/- 1.4%
Thickness	+/- 10 %
Ride Quality (IRI)	Per Subsection 450.65F(11)(c)

If the Contractor's Split Sample Correlation results differ from the Department's results by more than the allowable differences specified in Table 450.18, then the Contractor and the Department shall determine and resolve the reasons for the differences prior to the start or continuation of HMA Lot production and placement.

450.76 Lot Acceptance Determination Based on Inspection Results.

The Department's Acceptance Inspection results will be used in the final acceptance determination for all HMA Lots (Lot Category A, B, and C). Prior to final acceptance of each HMA Lot produced and placed, the Department will periodically evaluate all Acceptance inspection information for the prepared underlying surface and the Lot. The materials and product workmanship for the completed Work will be evaluated for conformance with the plans and the requirements specified in Subsections 450.53 thru 450.58.

When the Acceptance information identifies deficiencies in either material quality or product workmanship for any underlying surface location or HMA Sublot(s), the location or Sublot(s) will be isolated and further evaluated by the Engineer through additional Acceptance inspection (or sampling and testing, if relevant or possible). Depending upon the findings of the additional Acceptance inspection activity, the Engineer will determine the disposition of the nonconforming Work in accordance with Division I, Subsection 5.03, Conformity with Plans and Specifications.

After each HMA Lot (and corresponding prepared underlying surface) is complete, including any corrective action, the Engineer will evaluate all Acceptance inspection information for the Work. The Department will accept the subject Work if the Engineer's evaluation of all inspection information for the completed Lot (and underlying surface) indicates that the corresponding materials and product workmanship meet the specified requirements (provided the evaluation of all Acceptance testing data for the subject Work per Subsection 450.77 also finds the Work to be acceptable).

450.77 Lot Acceptance Determination Based on Testing Data.

A. Evaluation of Lot Category A Testing Data.

Prior to final acceptance of each HMA Category A Lot produced and placed, the Engineer will periodically evaluate all available Department Acceptance testing data for the Lot.

The Contractor's random QC testing data for each Lot will be included with the Department's random Acceptance testing data in the acceptance determination, provided that the QC data has been Validated in accordance with paragraph (1) below. The Department's Acceptance data and all Validated Contractor QC data will be evaluated using the Quality Limits specified in Table 450.19 and as further outlined below.

(1) Validation of Contractor QC Test Results.

Validation is defined as the mathematical comparison of two independently obtained sets of data to determine whether it can be assumed they came from the same Population. The Validation of each HMA Lot will be performed through a statistical comparison of the Engineer's random Acceptance testing data and the Contractor's random QC testing data for the Lot.

The statistical comparison of testing data will be made using the test result Variances (***F-test***) and the test result Means (***t-test***) at a significance level of 0.01 and in accordance with the procedures contained in Appendix F of the *AASHTO Implementation Manual For Quality Assurance* (February 1996). The Validation worksheet in the Department's MS-Excel QA Data Spreadsheets will be used to perform the Validation of each Lot.

If the Validation results indicate that the Contractor's QC test results and the Department's Acceptance test results can be assumed to be from the same Population, then the Contractor's QC test results will be included with the Department's Acceptance test results in the final acceptance determination for each Lot.

If the Validation results indicate that the Contractor's QC test results and the Department's Acceptance test results cannot be assumed to be from the same Population, then the Department will endeavor to determine the reason for the difference between the two data sets. If a reason for the difference cannot be determined, then only the Department's Acceptance test results will be used in the final acceptance determination for each Lot.

(2) Conformance with Engineering Limits.

The Engineer will evaluate all Department Acceptance testing data and Validated Contractor QC testing data for each Category A Lot to determine conformance with the Engineering Limits in Table 450.19. Each Sublot test value for the Acceptance Quality Characteristics identified in Table 450.19 shall be within the Engineering Limits.

If a Sublot test result is outside of the Engineering Limits, the Engineer will further assess the Sublot quality to determine whether the material in the Sublot can remain in place. The Engineer will isolate the Sublot and perform selective sampling followed by additional random sampling (if possible) within the Sublot to quantify the actual quality of the Sublot. The Engineer will determine the disposition of the Sublot in accordance with Division I, Subsection 5.03, Conformity with Plans and Specifications. If the Engineer's assessment determines that the material quality is sufficient to permit the Sublot to remain in place without corrective action, all random testing data for the Sublot (including the original out of Engineering Limit test result) will be included in the Quality Level Analysis for the Lot in accordance with paragraph (3) below.

When a nonconforming Sublot is corrected or replaced, the Engineer will perform Acceptance testing of the Sublot and evaluate the test results for conformance with the Engineering Limits. The Acceptance test data for the corrected Sublot will replace the original Acceptance test result and will be include in the Quality Level Analysis for the Lot in accordance with paragraph (3) below. Once the above requirements have been met, the Department will accept all completed Sublots, provided that the overall Lot quality is above the Acceptance Limit as further outlined below.

(3) Analysis of Lot Quality Level.

For each HMA Category A Lot, the Engineer will determine the Lot Quality Level, for the applicable Quality Characteristics in Table 450.19, using the Quality Level Analysis (QLA) procedures outlined in Subsection 450.78. The QLA procedure will evaluate all Department Acceptance testing data and Validated Contractor QC testing data using the Specification Limits in Table 450.19. The Department's MS-Excel QA Data Spreadsheets will be used to perform the QLA for each Lot.

All random test results that are within the Engineering Limits will be included in the Quality Level Analysis. Individual Sublot test results that are beyond the Engineering Limits, but for which the corresponding Sublot is permitted to remain in place per paragraph (2) above, will also be included in the Quality Level Analysis.

The QLA procedure will determine the Percent Within Limits (PWL) for each Lot. The Acceptance Limit (Rejectable Quality Level) for each completed Lot is 60 PWL. Each Lot must achieve a final Quality Level of at least 60 PWL in order to be accepted by the Department.

If the final computed Lot Quality Level is at 90 PWL, the Contractor will receive full payment at the unit bid price for the Lot. If the Lot Quality Level is greater than 90 PWL, the Contractor will receive an incentive pay adjustment for the Lot in accordance with Subsection 450.92. If the Lot Quality Level is less than 90 PWL but greater than or equal to 60 PWL, the Contractor will receive a disincentive pay adjustment for the Lot. If the final computed Lot Quality Level is below 60 PWL, the Lot will not be accepted. Payment for the Lot will be withheld and the Contractor shall submit a corrective action plan within 14 days following determination of the Lot PWL. The Engineer will review the corrective action plan and render a decision within 14 days of receipt of the corrective action plan. If the Engineer determines that the Lot or some of the Sublots cannot remain in place, the Contractor shall remove and replace

the affected Lot or Sublots. If the Engineer allows the Lot to remain in place, payment will be limited to a maximum of 75% of the bid price for the item.

(4) Final Lot Acceptance Determination.

After each HMA Category A Lot is complete, including any corrective action, the Engineer will perform a final evaluation of all Department Acceptance data and Validated Contractor QC data for the Lot. The Department will accept the subject Lot if the Engineer's evaluation of all testing data for the Lot is in conformance with the applicable Quality Limits as outlined in paragraph (2) and paragraph (3) above.

Table 450.19 - Quality Limits for Acceptance of HMA Lots

Quality Characteristic	Target	Specification Limits		Engineering Limits		Acceptance Limit
		LSL	USL	LEL	UEL	
PG Asphalt Binder Grading	Per Binder Grade specified	N/A	N/A	Per AASHTO M320	Per AASHTO M320	N/A
PG Asphalt Binder Content	Per JMF	Target - 0.3 %	Target + 0.3 %	Target - 0.4 %	Target + 0.4 %	60 PWL
Volumetrics: Air Voids	4 %	2.7 %	5.3 %	2 %	6 %	60 PWL
In-Place HMA Mat Density (Cores)	95 % of G_{mm}	92.5 % of G_{mm}	97.5 % of G_{mm}	92 % of G_{mm}	98 % of G_{mm}	60 PWL
In-Place HMA Mat Density (Bridge Courses)	95 % of G_{mm}	N/A	N/A	90 % of G_{mm}	N/A	N/A
Thickness: (All Courses 1 inch (25mm) or greater)	Per Plans	-20 % of Target Thickness	+20 % of Target Thickness	-30 % of Target Thickness	+30 % of Target Thickness	60 PWL
Ride Quality: Greater than or equal to 55 mph (90 km/hr)	50 in/mile (0.79 m/km)	N/A	70 in/mile (1.10 m/km)	N/A	80 in/mile (1.26 m/km)	60 PWL
Ride Quality: 40mph (65 km/hr) to 55 mph (90 km/hr)	70 in/mile (1.10 m/km)	N/A	100 in/mile (1.58 m/km)	N/A	110 in/mile (1.74 m/km)	60 PWL
Ride Quality: Less than 40 mph (65 km/hr)	Not subject to ride testing					

B. Evaluation of Lot Category B Testing Data.

Prior to final acceptance of each HMA Category B Lot produced and placed, the Engineer will periodically evaluate all available Department Acceptance testing data for the Lot.

The Contractor's random QC testing data for each Lot will be included with the Department's random Acceptance testing data in the acceptance determination, provided that the QC data has been Validated. The Department's Acceptance data and all Validated Contractor QC data will be evaluated for conformance with Engineering Limits and for Lot Quality Level in accordance with the requirements of Subsection 450.77A above using the applicable Quality Limits specified in Table 450.19.

After each HMA Category B Lot is complete, including any corrective action, the Engineer will perform a final evaluation of all Department Acceptance data and Validated Contractor QC data for the Lot. The Department will accept the subject Lot if the Engineer's evaluation of all testing data for the Lot is in conformance with the applicable Quality Limits.

C. Evaluation of Lot Category C Testing Data.

For each HMA Category C Lot produced and placed, the Engineer will evaluate all Department Acceptance testing data for the Lot entered into the Department's MS-Excel QA Data Spreadsheets after all HMA Sublots are complete in-place. The Contractor's random QC testing data for each Lot will not be included with the Department's random Acceptance testing data in the acceptance determination. The individual Sublot test results for each HMA Category C Lot will be evaluated against the Specification Limits contained in Table 450.19 (Note: the Engineering Limits are not applied since the inherent variability for Minor Lot quantities is expected to be within the Specification Limits). Work under HMA Lot Category C will not be subject to an evaluation of Lot Quality Level using QLA procedures.

If a Sublot test result is outside of the Specification Limits, the Engineer will further assess the Sublot quality in accordance with the requirements of Subsection 450.77A(2). The Engineer will determine the disposition of the Sublot in accordance with Division I, Subsection 5.03, Conformity with Plans and Specifications.

After each HMA Category C Lot is complete, including any corrective action, the Engineer will perform a final evaluation of all Department Acceptance data. The Department will accept the subject Lot if the Engineer's evaluation of the testing data for each Sublot is in conformance with the Specification Limits.

450.78 Quality Level Analysis Procedures.

For each Quality Characteristic subject to analysis of Lot Quality Level, the Quality Level Analysis (QLA) - Standard Deviation Method will be used to determine the percentage of the Lot that is within the Specification Limits. The number of significant figures retained in each step of the QLA calculations and the rounding of all reported values will be as established in the Department's MS Excel QA Data Spreadsheets. The estimated percentage of Work that is within the Specification Limits for a given Lot will be determined as follows:

A. Step 1 – Determine Lot Mean.

The Mean (X) will be determined for each Lot using all random Department Acceptance sample test values and all random Contractor QC sample test values (provided they have been Validated). The Mean is calculated using the following equation:

$$X = \frac{\Sigma x}{n}$$

Where: Σ = summation of
x = individual test value of each material sample
n = total number of material samples tested

B. Step 2 – Determine Lot Standard Deviation.

The Standard Deviation (s) will be determined for each Lot using all random Department Acceptance sample test values and all random Contractor QC sample test values (provided they have been Validated). The Standard Deviation is calculated using the following equation:

$$s = \sqrt{\frac{n\Sigma(x^2) - (\Sigma x)^2}{n(n-1)}}$$

Where: $\Sigma(x^2)$ = summation of the squares of individual test values
$(\Sigma x)^2$ = summation of the individual test values squared

C. Step 3 – Determine Upper Quality Index for Lot.

The Upper Quality Index (Q_U) will be determined for each Lot using the Lot Mean and Lot Standard Deviation calculated in Step 1 and Step 2 above. The Upper Quality Index is calculated using the following equation:

$$Q_u = \frac{USL - X}{s}$$

Where: USL = Upper Specification Limit from Table 450.19
X = The Lot Mean
s = The Lot Standard Deviation

D. Step 4 – Determine Lower Quality Index for Lot.

The Lower Quality Index (Q_L) will be determined for each Lot using the Lot Mean and Lot Standard Deviation calculated in Step 1 and Step 2 above. The Upper Quality Index is calculated using the following equation:

$$Q_L = \frac{X - LSL}{s}$$

Where: LSL = Lower Specification Limit from Table 450.19
X = The Lot Mean
s = The Lot Standard Deviation

E. Step 5 – Determine Percentage of Lot Below Upper Specification Limit.

The estimated percentage of the Lot falling below the Upper Specification Limit (P_U) will be determined using Table 450.20. The P_U value is determined from the table by entering the column for the number of material samples (n) representing the Lot and locating the row that corresponds to the Q_u value determined in Step 3 above. If no USL is specified in Table 450.20, the P_U value is equal to 100.

F. Step 6 – Determine Percentage of Lot Above Lower Specification Limit.

The estimated percentage of the Lot falling above the Lower Specification Limit (P_L) will be determined using Table 450.20. The P_L value is determined from the table by entering the column for the number of material samples (n) representing the Lot and locating the row that corresponds to the Q_L value determined in Step 4 above. If no LSL is specified in Table 450.20, the P_L value is equal to 100.

G. Step 7 – Determine Estimated Percent Within Limits for Lot.

The Lot Quality Level will be determined by estimating the Percent Within Limits (PWL). The PWL is determined using the P_U value from Step 5 and the P_L value from Step 6 above. The Percent Within Limits is calculated using the following equation:

$$PWL = (P_U + P_L) - 100$$

Table 450.20 - Values for Estimating Percent of Lot Within Specification Limits

	Upper Quality Index (Q_U) or Lower Quality Index (Q_L)														
P_U Or P_L (%)*	n = 3	n = 4	n = 5	N = 6	n = 7	n = 8	n = 9	n = 10 to n = 11	n = 12 to n = 14	n = 15 to n = 18	n = 19 to n = 25	n = 26 to n = 37	n = 38 to n = 69	n = 70 to n = 200	n = 201 to n = ∞
100	1.16	1.50	1.79	2.03	2.23	2.39	2.53	2.65	2.83	3.03	3.20	3.38	3.54	3.70	3.83
99		1.47	1.67	1.80	1.89	1.95	2.00	2.04	2.09	2.14	2.18	2.22	2.26	2.29	2.31
98	1.15	1.44	1.60	1.70	1.76	1.81	1.84	1.86	1.91	1.93	1.96	1.99	2.01	2.03	2.05
97		1.41	1.54	1.62	1.67	1.70	1.72	1.74	1.77	1.79	1.81	1.83	1.85	1.86	1.87
96	1.14	1.38	1.49	1.55	1.59	1.61	1.63	1.65	1.67	1.68	1.70	1.71	1.73	1.74	1.75
95		1.35	1.44	1.49	1.52	1.54	1.55	1.56	1.58	1.59	1.61	1.62	1.63	1.63	1.64
94	1.13	1.32	1.39	1.43	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.55
93		1.29	1.35	1.38	1.40	1.41	1.42	1.43	1.44	1.44	1.45	1.46	1.46	1.47	1.47
92	1.12	1.26	1.31	1.33	1.35	1.36	1.36	1.37	1.37	1.38	1.39	1.39	1.40	1.40	1.40
91	1.11	1.23	1.27	1.29	1.30	1.30	1.31	1.31	1.32	1.32	1.33	1.33	1.33	1.34	1.34
90	1.10	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.26	1.27	1.27	1.27	1.28	1.28	1.28
89	1.09	1.17	1.19	1.20	1.20	1.21	1.21	1.21	1.21	1.22	1.22	1.22	1.22	1.22	1.23
88	1.07	1.14	1.15	1.16	1.16	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.13	1.13
86	1.04	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
84	1.01	1.02	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95
82	0.97	0.96	0.95	0.94	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
81	0.96	0.93	0.91	0.90	0.90	0.89	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88
80	0.93	0.90	0.88	0.87	0.86	0.86	0.86	0.85	0.85	0.85	0.85	0.84	0.84	0.84	0.84
79	0.91	0.87	0.85	0.84	0.83	0.82	0.82	0.82	0.82	0.81	0.81	0.81	0.81	0.81	0.81
78	0.89	0.84	0.82	0.80	0.80	0.79	0.79	0.79	0.78	0.78	0.78	0.78	0.77	0.77	0.77
77	0.87	0.81	0.78	0.77	0.76	0.76	0.76	0.75	0.75	0.75	0.75	0.74	0.74	0.74	0.74
76	0.84	0.78	0.75	0.74	0.73	0.73	0.72	0.72	0.72	0.71	0.71	0.71	0.71	0.71	0.71
75	0.82	0.75	0.72	0.71	0.70	0.70	0.69	0.69	0.69	0.68	0.68	0.68	0.68	0.68	0.67
74	0.79	0.72	0.69	0.68	0.67	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.65	0.64	0.64
73	0.76	0.69	0.66	0.65	0.64	0.63	0.63	0.63	0.62	0.62	0.62	0.62	0.62	0.61	0.61
72	0.74	0.66	0.63	0.62	0.61	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.58	0.58
71	0.71	0.63	0.60	0.59	0.58	0.57	0.57	0.57	0.57	0.56	0.56	0.56	0.56	0.55	0.55
70	0.68	0.60	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.52
69	0.65	0.57	0.54	0.53	0.52	0.52	0.51	0.51	0.51	0.50	0.50	0.50	0.50	0.50	0.50
68	0.62	0.54	0.51	0.50	0.49	0.49	0.48	0.48	0.48	0.48	0.47	0.47	0.47	0.47	0.47
67	0.59	0.51	0.47	0.47	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44
66	0.56	0.48	0.45	0.44	0.44	0.43	0.43	0.43	0.42	0.42	0.42	0.42	0.41	0.41	0.41
65	0.52	0.45	0.43	0.41	0.41	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.36
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.33
62	0.43	0.36	0.34	0.33	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.28
60	0.36	0.30	0.28	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25
59	0.32	0.27	0.25	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23
58	0.29	0.24	0.23	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20
57	0.25	0.21	0.20	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
56	0.22	0.18	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15
55	0.18	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
54	0.14	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
53	0.11	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
52	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
51	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: If the calculated value of Q_U or Q_L does not correspond exactly to a value in the table, use the next lower value.
If Q_U or Q_L are negative values, P_U or P_L is equal to 100 minus the table value for P_U or P_L.
***** P_U or P_L = Percent Within limits for positive values of Q_U or Q_L

DISPUTE RESOLUTION

450.80 Disputable items

The Contractor or the Department may dispute any of the test values that are utilized in the acceptance determination for a given Lot. The specific Quality Characteristics which may be disputed are as listed in Table 450.21 below. All disputes shall be initiated within the 30 day split sample retention time limit as specified in Subsection 450.82 below.

450.81 Basis for Dispute

Differences from one individual Contractor QC test value to another (or from one individual Department Acceptance test value to another) within a Lot are expected due to inherent variability. Differences are also expected between the QC test values and the Acceptance values for a given Lot as a result of inherent variability. An individual QC test value cannot be directly compared to an individual Acceptance test value since the samples are randomly obtained independent of one another. However, if one or more of the Contractor's random QC test values for a Lot significantly differs from the Department's Acceptance test values for the same Lot, either party may dispute the validity of an individual test value.

450.82 Dispute Resolution Samples

Samples used for Dispute Resolution testing shall be the split samples required to be retained for thirty (30) days by the Contractor and the Department in accordance with Subsection 450.65D and Subsection 450.74E. Original cores are to be retained and shall be protected from damage. If In-place density or thickness is disputed, then the original core, unless damaged, will be used in the Dispute Resolution process. If the original disputed core is damaged, then a new core shall be obtained from within a 2-foot (600mm) radius of the location of the original core by the party whose data is being disputed in the presence of the other party. If ride quality smoothness test data is disputed, then the disputed Sublot(s) shall be re-sampled/retested by the party whose data is being disputed in the presence of the other party.

450.83 Dispute Resolution Steps

The Contractor may dispute the Department's Acceptance results and the Department may dispute the Contractor's Quality Control results by requesting that the dispute resolution split sample be tested. Such a request, either from the Contractor or the Department, must be made in writing within five days after the original sample was obtained. The following shall be provided in the written request:

- Sample reference number, including Lot and Sublot
- The specific Quality Characteristic and test result(s) being disputed
- The complete NETTCP test report form containing the disputed results

A. Step 1 – Split Sample Correlation.

Immediately prior to conducting testing for Dispute Resolution, the Contractor's QC testing personnel, the Department's Acceptance testing personnel (from the District), and a Department Independent Assurance (IA) technician will conduct Split Sample Correlation testing as detailed in Subsection 450.75. Split Sample Correlation testing will be conducted on a separate material sample obtained independent from the original sample and the Dispute Resolution sample.

The purpose of the Split Sample Correlation testing is to determine if testing procedures or equipment utilized by the Contractor or the Department might be the cause of the disputed result(s).

B. Step 2 – Dispute Resolution Sample Testing.

If a Department Acceptance test value is being disputed, the Department's Acceptance testing personnel (from the District) will test the Dispute Resolution split sample. If a Contractor QC test value is being disputed, the Contractor's QC testing personnel will test the Dispute Resolution split sample. In either case, testing of the Dispute Resolution split sample shall be performed by the same Contractor QC testing personnel and Department Acceptance testing personnel that performed the split sample correlation in step 1 above. Testing of the Dispute Resolution split sample shall be performed in the presence of both the Contractor and the Department.

C. Step 3 – Additional Dispute Resolution Testing.

If either the Contractor or the Department believes that the results of the Dispute Resolution split sample testing in Step 2 above do not conclusively resolve the dispute, additional sampling and testing within the disputed Sublot may be requested. In such case, an independent AASHTO accredited laboratory will be utilized to obtain and test three (3) random samples from the disputed Sublot. The Mean of the three test results will be used as the Dispute Resolution test value.

450.84 Final Disposition.

If the difference between the original test value and the Dispute Resolution test value (as determined under either Step 2 or Step 3 above) is within the maximum test difference values listed in Table 450.21, then the original test value will be used in the acceptance determination for the Lot. If the difference between the original test value and the Dispute Resolution test value exceeds the maximum difference values in Table 450.21, then the Dispute Resolution test value will be used in the acceptance determination. In such case, the record of the original test value will be retained (with notation of the outcome of Dispute Resolution); however, it will not be used in calculating the Lot quality level.

Table 450.21 – Dispute Resolution Maximum Test Difference Values

Quality Characteristic	Maximum Test Difference
Maximum Specific Gravity (G_{mm})	+/- 0.020
Bulk Specific Gravity (G_{mm})	+/- 0.030
PG Asphalt Binder Content	+/- 0.4
Volumetrics - Air Voids	+/- 1.4
In-place HMA Mat Density	+/- 1.4
Thickness	+/- 10% of original value
Ride Quality (IRI)	+/- 10% of original value

COMPENSATION

450.90 Method of Measurement.

A. Patching.

HMA for Patching will be measured for payment by the ton (Megagram) and shall be the actual quantity complete, in place and accepted by the Engineer.

B. Tack Coat.

Asphalt Emulsion for Tack Coat, as required by the plans or these specifications, will be measured by the gallon (liter).

C. Joint Sealer.

HMA Joint Sealant used for sealing all longitudinal joints and transverse joints in HMA pavement courses will be measured by the linear foot (linear meter).

D. Hot Mix Asphalt.

Hot Mix Asphalt pavement course mixtures will be measured by the ton (Megagram) and shall be the actual pavement course quantity complete, in place and accepted by the Engineer. The quantity shall be determined only by weight slips that have been properly countersigned by the Engineer at the time of delivery.

E. Contractor Quality Control.

The Contractor's Quality Control system as specified in Subsection 450.60 through Subsection 450.69 will be measured by the ton (Megagram) and shall be represented by the actual quantity of HMA for Patching and all HMA pavement courses complete, in place and accepted by the Engineer.

450.91 Basis of Payment.

A. Patching.

HMA for Patching will be paid for at the contract unit price per ton (Megagram) of the HMA mixture type specified under Pay Item 451. Payment shall include all sawcutting, removal of existing distressed or unsound pavement, applying hot poured rubberized asphalt sealant to vertical faces, and transportation, delivery, placement, and compaction of HMA for Patching in accordance with Subsection 450.53C.

B. Tack Coat.

Asphalt Emulsion for Tack Coat will be paid for at the contract unit price per gallon (liter) of applied tack coat under Pay Item 452. Payment shall include sweeping existing surfaces and applying the tack coat to all required surfaces at the specified rate in accordance with Subsection 450.53F.

C. Joint Sealer.

HMA Joint Sealant will be paid for at the contract unit price per linear foot (linear meter) of joint sealed under Pay Item 453. Payment shall include application of the joint sealer to all longitudinal joints and transverse joints in HMA pavement courses as required and in accordance with Subsection 450.57.

D. Hot Mix Asphalt.

Each Hot Mix Asphalt pavement course will be paid for at the contract unit price per ton (Megagram) of in-place mixture under the HMA Pay Items specified (Pay Items 450.10 through 450.70). Payment shall include sweeping the underlying surface, transportation, delivery, placement (including providing a MTV when required), and compaction of each HMA pavement course in accordance with Subsection 450.54 through Subsection 450.58.

All sawcutting required for transverse joints or longitudinal joints in accordance with Subsection 450.57 shall also be included in the contract unit price for each HMA pavement course.

E. Contractor Quality Control.

The Contractor's Quality Control system will be paid for at the contract unit price per ton (Megagram) under Pay Item 450.90. Payment will be full compensation for all QC activities required under Subsection 450.50 through Subsection 450.69 including; the Construction Quality Meeting, providing the field reference system, preparing and maintaining the approved Quality Control Plan, preparing all HMA mixture designs, performing QC sampling, testing and inspection (including the Control Strip when required), evaluating all QC data, and maintaining proper QC records. No separate payment will be made for any assistance provided by the Contractor to the Engineer in obtaining Department Acceptance samples. Failure of the Contractor to perform adequate Quality Control in accordance with the specifications and the Contractor's approved QC Plan will be justification for withholding payment.

450.92 Pay Adjustment (PA).

Payment for each HMA Category A Lot and Category B Lot will be determined based on the final Lot Quality Level (PWL) computed in accordance with the QLA procedures contained in Subsection 450.78. Pay adjustments will be determined for each of the Acceptance Quality Characteristics identified in Table 450.22. The relative pay adjustment weight assigned to each of the HMA Quality Characteristics is indicated in Table 450.22.

Table 450.22 - Pay Adjustment Weight Assigned to HMA Quality Characteristics

HMA Quality Characteristics	Pay Adjustment Weight
PG Asphalt Binder Content	10 percent
Volumetrics - Air Voids	25 percent
In-Place HMA Mat Density	25 percent
Thickness	10 percent
Ride Quality (IRI)	30 percent

A. Lot Pay Factor.

A Pay Factor (PF) will be determined for each HMA Lot using the Quality Level (PWL) computed for the Lot and the equation below:

$$PayFactor(PF) = \frac{55 + 0.5(QualityLevel)}{100}$$

The Lot Pay Factor will be used to determine the pay adjustment for each Quality Characteristic as further outlined below.

B. Pay Adjustment for PG Asphalt Binder Content.

Pay adjustment for PG Asphalt Binder Content shall be applied to Pay Item 999.490 at the completion of the HMA Lot. The total Lot pay adjustment for PG Asphalt Binder Content will be determined as follows:

$$PA_{PGAB} = \Sigma(PF_i - 1)\ (Q_i)\ (P_i)\ (0.10)$$

Where: PA_{PGAB} = Pay adjustment in dollars for PG Asphalt Binder Content.

PF_i = Pay factor based on Quality Level (PWL) of PG Asphalt Binder Content for individual Lot (i).

Q_i = Quantity represented by individual Lot (i) in tons (Mg).

P_i = Contract unit price per ton (Mg) for individual Lot (i).

0.10 = Weight given to PG Asphalt Binder Content pay adjustment

C. Pay Adjustment for Volumetrics (Air Voids).

Pay adjustment for Volumetrics (Air Voids) shall be applied to Pay Item 999.491 at the completion of the HMA Lot. The total Lot pay adjustment for Volumetrics (Air Voids) will be determined as follows:

$$PA_{Air\ Voids} = \Sigma(PF_i - 1)\ (Q_i)\ (P_i)\ (0.25)$$

Where: $PA_{Air\ Voids}$ = Pay adjustment in dollars for Volumetrics (Air Voids).

PF_i = Pay factor based on Quality Level (PWL) of Volumetrics (Air Voids) for individual Lot (i).

Q_i = Quantity represented by individual Lot (i) in tons (Mg).

P_i = Contract unit price per ton (Mg) for individual Lot (i).

0.25 = Weight given to Volumetrics (Air Voids) pay adjustment

D. Pay Adjustment for In-Place HMA Mat Density.

Pay adjustment for In-Place HMA Mat Density shall be applied to Pay Item 999.492 at the completion of the HMA Lot. The total Lot pay adjustment for In-Place HMA Mat Density will be determined as follows:

$$PA_{In\text{-}Place\ Density} = \Sigma(PF_i - 1)\ (Q_i)\ (P_i)\ (0.25)$$

Where: $PA_{In\text{-}Place\ Density}$ = Pay adjustment in dollars for In-Place HMA Mat Density.

PF_i = Pay factor based on Quality Level (PWL) of In-Place HMA Mat Density for individual Lot (i).

Q_i = Quantity represented by individual Lot (i) in tons (Mg).

P_i = Contract unit price per ton (Mg) for individual Lot (i).

0.25 = Weight given to In-Place HMA Mat Density pay adjustment

E. Pay Adjustment for Thickness.

Pay adjustment for Thickness shall be applied to Pay Item 999.493 at the completion of the HMA Lot. The total Lot pay adjustment for Thickness will be determined as follows:

$$PA_{Thickness} = \sum (PF_i - 1)\ (Q_i)(P_i)\ (0.10)$$

Where: $PA_{Thickness}$ = Pay adjustment in dollars for Thickness.

PF_i = Pay factor based on Quality Level (PWL) of Thickness for individual Lot (i).

Q_i = Quantity represented by individual Lot (i) in tons (Mg).

P_i = Contract unit price per ton (Mg) for individual Lot (i).

0.10= Weight given to Thickness pay adjustment.

B. Pay Adjustment for Ride Quality.

Pay adjustment for Ride Quality shall be applied to Pay Item 999.494 at the completion of all HMA Lots. Although Ride Quality Acceptance testing will be performed only on the final pavement course, the pay adjustment will be applied to the total quantity of all HMA pavement courses placed. Since each wheel path of the final pavement course represents a Lot for Ride Quality, the quantity for each Lot shall be computed by dividing the total quantity of all pavement courses placed by the number of wheel paths for all lanes tested in the final pavement course. The total Lot pay adjustment for Ride Quality will be determined as follows:

$$PA_{Ride\ Quality} = \sum (PF_i - 1)\ (\sum (Q_{pc})(P_{pc}))/N_{wp}\ (0.30))$$

Where: $PA_{Ride\ Quality}$ = Pay adjustment in dollars for Ride Quality.

PF_i = Pay factor based on Quality Level (PWL) of Ride Quality for individual Lot (i).

Q_{pc} = Quantity represented by individual pavement course (pc) in tons (Mg).

P_{pc} = Contract unit price per ton (Mg) for individual pavement course (pc).

N_{wp} = Total number of wheel paths for all lanes tested.

0.30 = Weight given to Ride Quality pay adjustment.

450.93	Payment Items	Payment Unit
450.10	Open Graded Friction Course - Polymer Modified (OGFC-P)	Ton (Megagram)
455.21	SUPERPAVE Surface Course - 4.75 (SSC - 4.75)	Ton (Megagram)
455.22	SUPERPAVE Surface Course - 9.5 (SSC - 9.5)	Ton (Megagram)
455.23	SUPERPAVE Surface Course - 12.5 (SSC - 12.5)	Ton (Megagram)
455.24	SUPERPAVE Surface Course - 19.0 (SSC - 19.0)	Ton (Megagram)
455.31	SUPERPAVE Intermediate Course - 12.5 (SIC - 12.5)	Ton (Megagram)
455.32	SUPERPAVE Intermediate Course - 19.0 (SIC - 19.0)	Ton (Megagram)
455.41	SUPERPAVE Base Course - 25.0 (SBC - 25.0)	Ton (Megagram)
455.42	SUPERPAVE Base Course - 37.5 (SBC - 37.5)	Ton (Megagram)
455.51	SUPERPAVE Leveling Course - 4.75 (SLC - 4.75)	Ton (Megagram)
455.52	SUPERPAVE Leveling Course - 9.5 (SLC - 9.5)	Ton (Megagram)
455.53	SUPERPAVE Leveling Course - 12.5 (SLC - 12.5)	Ton (Megagram)
455.60	SUPERPAVE Bridge Surface Course - 9.5 (SSC-B - 9.5)	Ton (Megagram)
455.61	SUPERPAVE Bridge Surface Course - 12.5 (SSC-B - 12.5)	Ton (Megagram)
455.70	SUPERPAVE Bridge Protective Course - 9.5 (SPC-B - 9.5)	Ton (Megagram)
455.71	SUPERPAVE Bridge Protective Course - 12.5 (SPC-B - 12.5)	Ton (Megagram)
450.90	Contractor Quality Control	Ton (Megagram)
451	HMA for Patching	Ton (Megagram)
452	Asphalt Emulsion for Tack Coat	Gallon (Liter)
453	HMA Joint Sealant	Linear Foot (Meter)
999.490	HMA Pay Adjustment – PG Asphalt Binder Content [1]	Dollar
999.491	HMA Pay Adjustment – Volumetrics (Air Voids) [1]	Dollar
999.492	HMA Pay Adjustment – In-place Mat Density [1]	Dollar
999.493	HMA Pay Adjustment – Thickness [1]	Dollar
999.494	HMA Pay Adjustment – Ride Quality [1]	Dollar

[1] Not a bid item

SECTION 455
SUPERPAVE HOT MIX ASPHALT PAVEMENT

Section 455 - SUPERPAVE Hot Mix Asphalt Pavement amends Section 450 - Hot Mix Asphalt Pavement. The provisions herein replace the Subsections of Section 450 as indicated.

NOTE: The HMA pavement produced and placed for this project is part of a Gyratory Compaction Study evaluating the placement and performance characteristics of HMA pavements designed at different Superpave gyration levels.

For any HMA pavement course/mixture type having a project quantity ≥15,000 Tons, at least 50% of the pavement course/mixture type quantity shall be designed and produced using the design criteria in Table 455.5A (Standard Superpave HMA) and at least 40% of the pavement course/mixture type quantity shall be designed and produced using the design criteria in Table 455.5B (Modified Superpave HMA).

For any HMA pavement course/mixture type having a project quantity <15,000 Tons, at least 50% of the pavement course quantity shall be designed and produced using the design criteria in Table 455.5A (Standard Superpave HMA) and at the Contractor's option, up to 50% of the pavement course/mixture type quantity may be designed and produced using the design criteria in Table 455.5B (Modified Superpave HMA).

For each HMA pavement course/mixture type, both mix designs (Standard Superpave HMA - Table 455.5A and Modified Superpave HMA - Table 455.5B) shall use the same source of materials (i.e. Aggregates, PG Asphalt Binder, RAP, MAS) for the LTMF and HMA production.

All Study samples (loose mixture and cores) will be obtained by MassDOT personnel in conjunction with Acceptance samples. These Study samples will be drawn from either a split sample of each randomly obtained Department Acceptance sample or from separate random samples obtained by the Department. The Contractor shall also provide a split sample from each random QC sample if requested by the Department. Each sample will be clearly marked to indicate that it is from a Standard Superpave Mixture (S) or from a Modified Superpave Mixture (M). The Study will analyze all QC and Acceptance testing data from this project for all Quality Characteristics tested for Acceptance.

The Contractor shall submit with their Quality Control Plan a written Gyratory Compaction Study Plan delineating the location, limits and estimated pavement course/mixture type quantities of Standard Superpave HMA and Modified Superpave HMA to be designed, produced, and placed. The Contractor shall cooperate and coordinate with MassDOT to obtain Study samples (loose mixture plant-produced HMA samples and cores) and to share all project testing data in accordance with MassDOT's Study Work Plan. The Contractor shall also record and submit to MassDOT the equipment, rolling patterns, and relative compactive effort utilized to achieve the specified HMA pavement density for each pavement course/mixture type placed.

DESCRIPTION

Delete Subsection 450.20 - General and replace with the following:

455.20 General.

This work shall consist of producing and placing Hot Mix Asphalt (HMA) pavement. All HMA mixtures shall meet the requirements of the SUPERPAVE volumetric design system. The HMA pavement shall be constructed in courses on the prepared or existing base in accordance with these specifications and in conformance with the lines, grades, compacted thickness and typical cross section as shown on the plans. Each SUPERPAVE HMA pavement course placed shall be comprised of one of the mixture types listed in Table 455.1.

Table 455.1 - SUPERPAVE HMA Pavement Courses & Mixture Types

Pavement Course	Mixture Type	Mixture Designation
Friction Course	• Open-Graded Friction Course - Polymer Modified	OGFC – P
Surface Course	• SUPERPAVE Surface Course - 4.75 • SUPERPAVE Surface Course - 9.5 • SUPERPAVE Surface Course - 12.5 • SUPERPAVE Surface Course - 19.0	SSC - 4.75 SSC - 9.5 SSC - 12.5 SSC - 19.0
Intermediate Course	• SUPERPAVE Intermediate Course - 12.5 • SUPERPAVE Intermediate Course - 19.0	SIC - 12.5 SIC - 19.0
Base Course	• SUPERPAVE Base Course - 25.0 • SUPERPAVE Base Course - 37.5	SBC - 25.0 SBC - 37.5
Leveling Course	• SUPERPAVE Leveling Course - 4.75 • SUPERPAVE Leveling Course - 9.5	SLC - 4.75 SLC - 9.5
Bridge Surface Course	• SUPERPAVE Bridge Surface Course - 9.5 • SUPERPAVE Bridge Surface Course - 12.5	SSC-B - 9.5 SSC-B - 12.5
Bridge Protective Course	• SUPERPAVE Bridge Protective Course - 9.5 • SUPERPAVE Bridge Protective Course - 12.5	SPC-B - 9.5 SPC-B - 12.5

When a SUPERPAVE Surface Course - 19.0 (SSC - 19.0) is specified in the contract, the Laboratory Trial Mix Formula (LTMF) aggregate gradation shall provide a fine-graded HMA mixture as defined in Subsection 455.42F.

MATERIALS

Delete Subsection 450.40 - General and replace with the following:

455.40 General.

SUPERPAVE HMA mixtures shall be composed of the following: Mineral aggregate, mineral filler (if required), Performance Graded Asphalt Binder (PGAB), and as permitted, reclaimed materials (limited to Reclaimed Asphalt Pavement (RAP), Reclaimed Asphalt Shingles (RAS), and Processed Glass Aggregate (PGA)). Materials shall meet the requirements in the following Subsections of Division III, Materials and as otherwise specified herein:

Asphalt Emulsion	M3.03.0
Hot Poured Joint Sealer	M3.05.0
Asphalt Anti-Stripping Additive	M3.10.0
Mineral Aggregate	M3.11.04
Mineral Filler	M3.11.05
Plant Requirements	M3.11.07

Delete Subsection 450.42 - Hot Mix Asphalt Mix Design and replace with the following:

455.42 SUPERPAVE Hot Mix Asphalt Mixture Design.

The Contractor shall be responsible for development of all SUPERPAVE HMA mixture designs. All HMA surface courses, intermediate courses, base courses, leveling courses, bridge surface courses, and bridge protective courses shall be supported by volumetric mixture designs using the SUPERPAVE mixture design system. All SUPERPAVE HMA mixture designs shall be developed in accordance with the following AASHTO standards, as modified herein:

AASHTO M 323
AASHTO R 35
AASHTO T 312

Volumetric mixture designs are not required for OGFC. The aggregate gradation structure and target PG Asphalt Binder content for Open-Graded Friction Course - Polymer Modified (OGFC-P) shall conform to the master ranges in M3.11.03 – Table B.

A. Development of Laboratory Trial Mix Formula (LTMF).

The Contractor shall develop and submit for Department approval, a minimum of forty-five (45) days prior to the start of SUPERPAVE HMA pavement construction, a Laboratory Trial Mix Formula (LTMF) as the proposed Job Mix Formula (JMF) for each SUPERPAVE mixture type to be used on the project. Two or more JMFs per HMA mixture type may be approved for a particular plant, however, only HMA conforming to one JMF is permitted to be produced and placed on any given day.

The following is a general outline of the steps for developing an LTMF and an approved JMF:

1. Estimate Percentage of RAP to be utilized and select PG Asphalt Binder as required by the specifications (Subsection 455.42C.);
2. Evaluate aggregates (and reclaimed materials) for conformance with Consensus Properties (Subsection 455.42D.) and Source Properties (Subsection 455.42E.);
3. Develop trial aggregate blends and estimate PG Asphalt Binder content in accordance with AASHTO R 35. Compact each of the blends. Based on volumetric analysis, select the best trial blend that meets the requirements of M 323 (Subsections 455.42F and 455.42G.);
4. Determine volumetric properties of LTMF and select PG Asphalt Binder content (Subsection 455.42H.);
5. Evaluate Moisture Sensitivity of the mixture (Subsection 455.42I.);
6. LTMF to be verified in the laboratory by the Department (Subsection 455.43);
7. Through production of a Control Strip Lot, verify that LTMF can be produced through the plant. (Subsection 450.66B.). Verification of the LTMF results in an approved JMF;
8. Repeat process for all mixtures to be utilized.

B. Estimated Design Traffic.

The estimated traffic level to be used for SUPERPAVE HMA mixture designs for this contract, expressed in Equivalent Single Axle Loads (ESALs) for the design travel lane over a 20-year period, is **XX** Million 18-kip (80-kn) ESALs.

C. Performance Graded Asphalt Binder.

The Asphalt Binder used for all HMA mixtures under this contract shall comply with the requirements of Subsection 450.48. The PGAB Grade selected for this Contract is **PGXX-XX**. The Contractor shall provide PGAB samples to the Department for verification of each LTMF a minimum of forty-five (45) days prior to SUPERPAVE HMA production.

D. Aggregate Consensus Properties.

Aggregates utilized in SUPERPAVE HMA mixtures, including RAP if used in the mixture, shall be tested for conformance with the following Consensus Property requirements:

- Determining the Percentage of Fractured Particles in Coarse Aggregate (ASTM D 5821)
- Uncompacted Void Content of Fine Aggregate (AASHTO T 304 - Method A)
- Flat or Elongated Particles (ASTM D 4791)
- Clay Content/Sand Equivalent Test (AASHTO T 176)

The Consensus Property test results shall be submitted with the LTMF for each SUPERPAVE HMA mixture. The Contractor shall provide aggregate samples a minimum of forty-five (45) days prior to production for each LTMF to the Department for LTMF verification prior to SUPERPAVE HMA production. The required minimum or maximum criteria for each of the Consensus Property tests for the total aggregate blend are specified below in Table 455.2 below.

Table 455.2 - Aggregate Consensus Property Requirements

Traffic Level	Design ESALs 18-kip (80-kn))	Coarse Aggregate Angularity (1) (2) ASTM D5821 (Percent Minimum)		Fine Aggregate Angularity (1) AASHTO T 304 - Method A (Percent Minimum)		Flat or Elongated Particles (2) ASTM D4791 (Percent Maximum)	Sand Equivalent AASHTO T 176 (Percent Minimum)
-----	(million)	(Depth from final surface) ≤ 4 in (100 mm)	(Depth from final surface) > 4 in (100 mm)	(Depth from final surface) ≤ 4 in (100 mm)	(Depth from final surface) > 4 in (100 mm)	> # 4 (4.75 mm)	----
1	< 0.3	55/--	--/--	--	--	--	40
2	0.3 to < 3.0	75/--	50/--	40	40	10	40
3	3 to < 10	85/80	60/--	45	40	10	45
4	10 to < 30.0	95/90	80/75	45	40	10	45
5	≥ 30.0	100/100	100/100	45	45	10	50
	Design ESALS are the anticipated project traffic level expected on the design lane, projected over a 20 year period, regardless of the actual expected design life of the roadway.	Criteria presented as minimum values. 95/90 denotes that a minimum of 95% of the coarse aggregate, by mass, shall have one fractured face and that a minimum of 90% shall have two fractured faces.		Criteria presented as minimum percent air voids in loosely compacted fine aggregate passing the #8 (2.36 mm) sieve.		Criteria presented as maximum percent by mass of flat or elongated particles of materials retained on the #4 (4.75 mm) sieve, determined at 5:1 ratio.	Criteria presented as minimum values for fine aggregate passing the #4 (4.75 mm) sieve.

Notes:

(1) If less than 25% of a given layer is within 4 inches (100 mm) of the anticipated top surface, the layer may be considered to be below 4 inches (100 mm) for mixture design purposes.

(2) This criterion does not apply to #4 (4.75 mm) nominal maximum size mixtures.

Aggregate Source Properties.

The coarse mineral aggregate utilized in SUPERPAVE HMA mixtures shall be clean, crushed rock consisting of the angular fragments obtained by breaking and crushing shattered natural rock. It shall be free from dirt or other objectionable materials. The coarse aggregate, including RAP if used in the mixture, shall be tested for conformance with the following Source Property requirements:

- Toughness as Determined by: Los Angeles Abrasion (AASHTO T 96)
- Soundness as Determined by: Soundness (AASHTO T 104)
- Deleterious Materials as Determined by: Clay Lumps & Friable Particles (AASHTO T 112)
- Specific Gravity (AASHTO T 8)

Testing for each of the Source Properties shall be performed for each SUPERPAVE HMA mixture design developed for the project. The Source Property test results shall be submitted with the LTMF for each SUPERPAVE HMA mixture. The Contractor shall provide samples of each aggregate material from each stock pile, a minimum of forty-five (45) days prior to production for each LTMF to the Department for LTMF verification prior to SUPERPAVE HMA production. The requirements for each of the Source Properties are as indicated in Table 455.3 below.

Table 455.3 - Aggregate Source Property Requirements

Source Property Test	Limit
Toughness (AASHTO T 96)	Maximum Loss < 30 %
Soundness (AASHTO T 104)	Maximum Loss < 10 %
Deleterious Materials (AASHTO T 112)	Maximum Permissible < 0.5 %

F. SUPERPAVE Aggregate Gradation and Specific Gravity Requirements.

The combined aggregate blend for each SUPERPAVE HMA mixture shall conform to the Gradation Control Point requirements specified in Table 455.6 below. The results of the selected optimum Design Aggregate Structure shall be plotted on a 0.45 Power Chart and included with the LTMF.

The combined aggregate gradation shall be classified as coarse-graded when it passes below the Primary Control Sieve (PCS) control point as defined in Table 455.4. All other gradations shall be classified as fine graded.

The specific gravity of each coarse and fine aggregate component shall be determined in accordance with AASHTO T 85 and T 84 respectively, and the specific gravity of the mineral filler shall be determined in accordance with AASHTO T 100. The individual aggregate specific gravities shall be included with the LTMF. The Contractor shall provide samples of each aggregate material a minimum of forty-five (45) days prior to production for each LTMF to the Department for verification of the selected optimum Design Aggregate Structure and specific gravity of each stock pile.

Table 455.4 - Gradation Classification

PCS Control Point for Mixture Nominal Maximum Aggregate Size % Passing					
Nominal Maximum Aggregate Size	1-1/2" (37.5 mm)	1" (25.0 mm)	3/4" (19.0 mm)	1/2" (12.5 mm)	3/8" (9.5 mm)
Primary Control Sieve	3/8" (9.5 mm)	#4 (4.75 mm)	#4 (4.75 mm)	#8 (2.36 mm)	#8 (2.36 mm)
PCS Control point (% Passing)	47	40	47	39	47

G. Gyratory Compaction Criteria.

Each SUPERPAVE HMA mixture shall be designed and controlled during production using an approved Gyratory Compactor which meets the requirements of AASHTO T 312. Compaction shall be in accordance with the requirements of AASHTO T 312. The density of each SUPERPAVE HMA mixture shall be evaluated at the initial number of gyrations ($N_{initial}$), the design number of gyrations (N_{design}), and the maximum number of gyrations (N_{max}). The gyratory-compacted specimens for each LTMF shall meet the density requirements specified in Table 455.5 below.

H. Volumetric Design Requirements.

Each SUPERPAVE HMA mixture shall be designed in accordance with the volumetric mixture design specifications contained in AASHTO M 323 and procedures contained in AASHTO R 35, as modified herein. Each HMA mixture LTMF shall be tested for conformance with the following volumetric properties:

- Air Voids at N_{design} (V_a)
- Voids in the Mineral Aggregate at N_{design} (VMA)
- Voids Filled with Asphalt at N_{design} (VFA)
- Fines to Effective Asphalt Ratio ($P_{0.075}$ / P_{be})

The volumetric property test results shall be submitted with the LTMF for each SUPERPAVE HMA mixture. The required minimum or maximum criteria for each of the volumetric property tests are specified in Table 455.6 below.

Table 455.5A - Standard SUPERPAVE HMA Design Requirements

Traffic Level	Design ESALs	Number of Gyrations by Superpave Gyratory Compactor			Percent Density of Gmm from HMA Specimen			Voids Filled with Asphalt (VFA)* Based on Nominal Maximum Aggregate Size					
	(million)	Nini	Ndes	Nmax	Nini	Ndes	Nmax	#4 (4.75 mm)	3/8" (9.5 mm)	1/2" (12.5 mm)	3/4" (19.0 mm)	1" (25.0 mm)	1-1/2" (37.5 mm)
1	< 0.3	6	50	75	≤ 91.5	96.0	≤ 98.0	70 – 80	70 – 80	70 – 80	70 – 80	67 – 80	64 – 80
2	0.3 to < 3	7	75	115	≤ 90.5	96.0	≤ 98.0	65 – 78	65 – 78	65 – 78	65 – 78	65 – 78	64 – 78
3	3 to < 10	8	100	160	≤ 89.0	96.0	≤ 98.0	75 – 78	73 – 76	65 – 75	65 – 75	65 – 75	64 – 75
4	10 to < 30	8	100	160	≤ 89.0	96.0	≤ 98.0	75 – 78	73 – 76	65 – 75	65 – 75	65 – 75	64 – 75
5	≥ 30	9	125	205	≤ 89.0	96.0	≤ 98.0	75 – 78	73 – 76	65 – 75	65 – 75	65 – 75	64 – 75

*The VFA values contained in Table 455.5A have been modified from AASHTO M 323 to ensure adequate PG Asphalt Binder content in each SUPERPAVE HMA mixture.

Table 455.5B - Modified SUPERPAVE HMA Design Requirements

Traffic Level	Design ESALs	Number of Gyrations by Superpave Gyratory Compactor			Percent Density of Gmm from HMA Specimen			Voids Filled with Asphalt (VFA)* Based on Nominal Maximum Aggregate Size					
	(million)	Nini	Ndes**	Nmax	Nini	Ndes	Nmax	#4 (4.75 mm)	3/8" (9.5 mm)	1/2" (12.5 mm)	3/4" (19.0 mm)	1" (25.0 mm)	1-1/2" (37.5 mm)
1	< 0.3	6	50	75	≤ 91.5	96.0	≤ 98.0	70 – 80	70 – 80	70 – 80	70 – 80	67 – 80	64 – 80
2	0.3 to < 3	7	65	95	≤ 90.5	96.0	≤ 98.0	65 – 78	65 – 78	65 – 78	65 – 78	65 – 78	64 – 78
3	3 to < 10	8	80	120	≤ 89.0	96.0	≤ 98.0	75 – 78	73 – 76	65 – 75	65 – 75	65 – 75	64 – 75
4	10 to < 30	8	80	120	≤ 89.0	96.0	≤ 98.0	75 – 78	73 – 76	65 – 75	65 – 75	65 – 75	64 – 75
5	≥ 30	9	100	160	≤ 89.0	96.0	≤ 98.0	75 – 78	73 – 76	65 – 75	65 – 75	65 – 75	64 – 75

*The VFA values contained in Table 455.5B have been modified from AASHTO M 323 to ensure adequate PG Asphalt Binder content in each SUPERPAVE HMA mixture.

**The N_{design} gyration levels are selected based on depth from final pavement surface. When 75% or more of the depth of a pavement layer is greater than four (4) inches (100 mm) below the final pavement surface, that pavement layer shall be designed at the next lower Design Traffic Level in Table 455.5B.

Table 455.6 - Gradation and Volumetric Requirements

	SUPERPAVE HMA Mixture Nominal Maximum Aggregate Size												LTMF Verification Limits
Sieve	#4 (4.75 mm)		3/8" (9.5 mm)		1/2" (12.5 mm)		3/4" (19.0 mm)		1" (25.0 mm)		1-1/2" (37.5 mm)		Target ±
	CONTROL POINTS		CONTROL POINTS		CONTROL POINTS		CONTROL POINTS (5)		CONTROL POINTS		CONTROL POINTS		
Inches	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	
2	-	-	-	-	-	-	-	-	-	-	100	-	6.0
1.5	-	-	-	-	-	-	-	-	100	-	90	100	6.0
1	-	-	-	-	-	-	100	-	90	100	-	90	6.0
¾	-	-	-	-	100	-	90	100	-	90	-	-	6.0
½	100	-	100	-	90	100	-	90	-	-	-	-	6.0
3/8	95	100	90	100	-	90	-	-	-	-	-	-	6.0
#4	90	100	-	90	-	-	-	-	-	-	-	-	6.0
#8	-	-	35	67	31	58	26	49	19	45	15	41	5.0
#16	30	60	-	-	-	-	-	-	-	-	-	-	3.0
#30	-	-	-	-	-	-	-	-	-	-	-	-	3.0
#50	-	-	-	-	-	-	-	-	-	-	-	-	3.0
#100	-	-	-	-	-	-	-	-	-	-	-	-	2.0
#200	6	12	2	10	2	10	2	8	1	7	0	6	1.0
PB	-		-	-	-	-	-	-	-	-	-	-	0.3
VMA (3)	17.0		16.0		15.0		14.0		13.0		12.0		1.0
Va (%)	4.0		4.0		4.0		4.0		4.0		4.0		1.0
VFA	Per Table 455.5 ± 5 off LTMF		Per Table 455.5 ± 5 off LTMF		Per Table 455.5 ± 5 off LTMF		Per Table 455.5 ± 5 off LTMF		Per Table 455.5 ± 5 off LTMF		Per Table 455.5 ± 5 off LTMF		
Gse	LTMF value		LTMF value		LTMF value		LTMF value		LTMF value		LTMF value		0.02
Gmm	LTMF value		LTMF value		LTMF value		LTMF value		LTMF value		LTMF value		0.02
Dust/Pbe(2)	0.9 - 2.0		0.6 - 1.2		0.6 - 1.2		0.6 - 1.2		0.6 - 1.2		0.6 - 1.2		
Mixture Temp	265 - 325F(1)		265 - 325F (1)		265 - 325F (1)		265 - 325F (1)		265 - 325F (1)		265 - 325F (1)		
PCS (4)			Sieve #8	47	Sieve #8	39	Sieve #4	47	Sieve #4	40	Sieve 3/8"	47	

(1) Based on the final design PG Asphalt Binder certification. (2) Dust is considered to be the percent of material passing the #200 (75 µm) sieve. The calculated effective asphalt content (Pbe) shall be used for this calculation. (3) Voids in Mineral Aggregates shall be computed as specified by AASHTO R 35. (4) If the aggregate gradation passes beneath the PCS Control Point specified in Table 455.4, the dust-to-binder ratio range may be increased from 0.6-1.2 to 0.8-1.6 at the Engineer's discretion. (5) When used as a Surface Course under OGFC the Min % for the #8 (2.36 mm) Sieve should be 40.

I. Evaluation of LTMF for Moisture Sensitivity.

Each SUPERPAVE HMA mixture type, for both mix designs (Standard Superpave HMA - Table 455.5A and Modified Superpave HMA - Table 455.5B), shall be tested by the Contractor for Moisture Sensitivity in accordance with the requirements of AASHTO T 283. The compacted specimens for each LTMF shall exhibit a minimum tensile strength ratio of 80% as determined by AASHTO T 283. A minimum tensile strength ratio of 80% is required. The use of approved anti-stripping agents (either liquid or mineral) can be used to meet this requirement. If an anti-strip agent is required, it shall be included in the Contractor's cost.

The Moisture Sensitivity test results shall be submitted with the LTMF for each SUPERPAVE HMA mixture type. The Department will perform testing of the Moisture Sensitivity prior to SUPERPAVE HMA production as part of the verification of each LTMF.

J. Evaluation of LTMF for Rutting and Moisture Susceptibility.

Each SUPERPAVE LTMF that is designed for traffic levels two (2) through five (5) will be tested by the Department for rutting and moisture susceptibility using; the Hamburg Wheel Tracking Device in accordance with AASHTO T 324, the Asphalt Pavement Analyzer (APA) in accordance with AASHTO T 340, and AASHTO T 283. Each LTMF may also be evaluated by the Department using the Asphalt Mix Performance Tester (AMPT).

K. Evaluation of Plant Produced HMA for Rutting and Moisture Susceptibility.

Loose mixture plant produced Superpave HMA samples will be obtained during production and tested by the Department for rutting and moisture susceptibility using; the Hamburg Wheel Tracking Device in accordance with AASHTO T 324, the Asphalt Pavement Analyzer (APA) in accordance with AASHTO T 340, and AASHTO T 283. Each sample may also be evaluated by the Department using the Asphalt Mix Performance Tester (AMPT).

The Study samples will be drawn from either a split sample of each randomly obtained Department Acceptance sample or from separate random samples obtained by the Department. The Contractor shall also provide a split sample from each random QC sample if requested by the Department. Each sample will be clearly marked to indicate that it is from a Standard Superpave Mixture (S) or from a Modified Superpave Mixture (M).

Delete Subsection 450.66A. - Laboratory Verification of HMA Mix Design and replace with the following:

455.43 Verification of Laboratory Trial Mix Formula (LTMF)

The Contractor shall submit a LTMF with supporting documentation, a minimum of forty-five (45) days prior to production, to the Engineer with samples of blended aggregate material and PG Asphalt Binder. An adequate amount of the blended aggregate material and PG Asphalt Binder shall be supplied in order to verify the LTMF selected for production (proposed JMF).

If the Engineer is unable to verify the Contractor's LTMF in accordance with the LTMF Verification Limits in Table 455.7, then the Engineer will work with the Contractor to resolve the verification issue(s). **The Contractor shall not proceed with production and placement of the Control Strip (Section 450.66B.) until the LTMF is verified by the Engineer.**

Table 455.7 - SUPERPAVE HMA LTMF Verification Limits

Properties	LTMF Verification Limit
Asphalt Binder Content (P_b)	Target ± 0.3 percent

Gradation Passing #4 (4.75 mm) and Larger Sieves	Target ± 6.0 percent
Gradation Passing #8 (2.36 mm) Sieve	Target ± 5.0 percent
Gradation Passing #16 (1.18 mm) to #50 (0.30 mm) Sieve	Target ± 3.0 percent
Gradation Passing #100 (0.15 mm) Sieve	Target ± 2.0 percent
Gradation Passing #200 (75 μm) Sieve	Target ± 1.0 percent
Max. Theo. Specific Gravity (G_{mm})	Target ± 0.02
Air Voids (V_a)	Target ± 1.0 percent
Voids in Mineral Aggregate (VMA)	Target ± 1.0 percent
Voids Filled With Asphalt (VFA)	Target ± 5.0 percent
Bulk Specific Gravity (G_{mb})	Target ± 0.022