Project Manual

for the

CENTRAL SCHOOL

DRIVEWAY RECONSTRUCTION PROJECT

Town of Arlington, Massachusetts

27 Maple Street

Arlington, MA

Prepared by: Kyle Zick Landscape Architecture, Inc.

Preparation date: 8 May 2017

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(Based on the CSI MasterFormat© November 2006 Edition)

DIVISION 00: PROCUREMENT/CONTRACTING REQUIREMENTS

Update for Town of Arlington

TOWN OF ARLINGTON
MASSACHUSETTS

INVITATION TO BID

BID #17-30 CENTRAL SCHOOL DRIVEWAY RECONSTRUCTION PROJECT

Sealed bids for Central School Driveway Reconstruction Project for the Town of Arlington, Massachusetts, will be received at the Purchasing Department, 730 Massachusetts Avenue, Arlington, MA 02476 until **11:00 AM prevailing time, on May 25, 2017** at which time and place said bids will be publicly opened and read aloud.

All bids must be in a sealed envelope plainly marked:
BID #17-30 Central School Driveway Reconstruction Project

Bid Security in the form of a bid bond, cash, certified check, treasurer's or cashier's check payable to the Owner, is required in the amount of five percent of the bid, in accordance with Section 00200, INSTRUCTIONS TO BIDDERS.

A pre-bid conference will be held on Thursday May 18, 2017 at 8:30 AM at the Central School Building, 27 Maple Street, Arlington, MA 02476.

By-law of the Town of Arlington, Title 1, Article 16, Minority/Woman Workforce Participation in Construction Projects which exceed $200,000.00 is part and parcel of the bid.

Copies may be obtained at the Office of the Purchasing Agent, located at 730 Massachusetts Avenue, Arlington, Massachusetts 02476, from 9 a.m. to 12 noon and 1 to 4 p.m.

Contract Documents and plans will not be mailed.

Contract Documents and plans are available for down load and review on the Town Website:

www.arlingtonma.gov/purchasing

The selected contractor shall furnish a performance bond and a payment bond in amount at least equal to fifty percent (50%) of the contract price.

Minimum Wage Rates as determined by the Commissioner of the Division of Occupational Safety of the Executive Office of Labor and Workforce Development under the provisions of the Massachusetts General Laws Chapter 149, Section 26 to 27D, as amended, apply to this project.

All bids for this project are subject to applicable bidding laws of Massachusetts, including General Laws Chapter 30, Section 39M as amended.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of 30 working days, Saturdays, Sundays and legal holidays excluded after the opening of bids.

The Owner reserves the right to waive any informalities or to reject any or

all bids.

TOWN OF ARLINGTON

Adam W. Chapdelaine
Town Manager

INSTRUCTIONS TO BIDDERS

I. COMPLEMENTARY DOCUMENT

A. INVITIATION TO BID, including herewith, is complementary to this document and shall be reviewed by bidder for specific instruction which are not repeated herein.

2. STATUTES REGUALTING COMPETITIVE BIDDING

A. Bidding procedures and award of general contract and subcontracts shall be in accordance with the provisions of Chapter 30, Section 39M and Chapter 149, Section 44A through 44L inclusive, of the General Laws of the Commonwealth of Massachusetts, including all current amendments.

B. In the event of any discrepancy or inconsistency between the provisions of these Bid and Contract Documents and the above-mentioned statutes, the provisions of the above-mentioned statutes shall govern. In such event, the application of all remaining provisions not in conflict to any circumstance other than that in which the conflict occurs shall not be affected thereby.

3. BIDDER'S QUALIFICATIONS

A. DCPO Certification not required.

B. The Contractors' Update Statements are not public records and will not be open to public inspection.

4. INTERPRETATION OF DOCUMENTS: NOTIFICATION OF ERRORS

A. Interpretations of the provisions of the Bid and Contract Documents will be made by the designer upon written request of any general bidder or sub-bidder, provided that such request is received by the Designer at least seven (7) days prior to the date of the applicable bid opening, and that the Designer considers such interpretation to be of sufficient importance. Oral or telephone interpretations will not generally be made, and if made shall be strictly informal and not legally valid or binding.

B. Such written interpretations shall be in the form of Addenda to the Bid and Contract Documents.

C. Bidders are urged to communicate all errors and discrepancies found in the Bid and Contract Documents to the Designer. Telephone calls pointing out any such errors or discrepancies will be taken by the Designer, but only for the purpose of receiving the information in order that it may be properly processed, and not for interpretation or clarification.

5. EXAMINATION OF BIDDING AND CONTRACT DOCUMENTS

A. Each Bidder shall carefully examine the Bid and Contract Documents to obtain a thorough understanding of the work of his bid in addition to the work of related trades. In addition, each General Bidder shall personally visit the

site to thoroughly acquaint himself/herself with the conditions as they exist hereon.

B. Failure of any Bidder to thoroughly examine the Bid and Contract Documents or to visit and examine the site shall in no way relieve him/her of any obligation with respect to his/her bid or of any responsibility assigned to him under the Contract.

6. PRE-BID CONFERENCE

A. Pre-bid conference will be held at the location and time stipulated in the Invitation to Bid.

7. MODIFICATION AND WITHDRAWAL OF BIDS

A. Modification of withdrawal of Bids will be permitted after the submission of such bids provided clearly written, readily understandable instructions for same are received by the Owner in writing prior to the time established for opening of such bids. No Bid may be withdrawn after that time, except as otherwise provided herein or by law.

8. ADDENDA

A. Addenda may be required during the bidding period to modify, clarify or interpret the Bid and Contract Documents. It is intended, but not guaranteed, that such Addenda shall be mailed by the Owner to all persons or parties to whom Bid and Contract Documents have been issued (Bidders of Record). Failure to receive such Addend shall in no way relieve any bidder from the execution of its provisions. All bidders are cautioned to verify the number of Addenda which have been issued and to secure any needed copies from the Designer before submitting a Bid.

9. FORM FOR BIDS

A. The Owner will make available, to every person applying therefor, a Bid Form. Each bona fide Bidder will be furnished forms for his proposal upon request. Such forms will be made available at the Owner's office during the regular office hours throughout the bidding period. Bids must be submitted on the forms provided by Owner or of forms included in the bid documents of the Project Manual.

B. All blank spaces provided on the bid forms shall be filled in with ink or typewriter. Where space if provided, sums shall be expressed in both words and figures. In case of a discrepancy between the two, the written words shall govern.

C. No interlineations, additional, alterations or erasures shall be made on the forms.

10. ALTERNATES

A. Each Bidder shall bid on alternatives listed. In the event that any alternate does not involve a change in the amount of the Bid, the Bidder shall so

indicate by using the words "No Change" in the space provided for that alternate.

B. General Bidders shall enter on the form for General Bid a single amount for each alternate, each amount to consist of the total of all the subbidders' amounts for the given alternate plus the amount of for work of the alternate to be performed by the General Contractor.

C. If alternate(s) are accepted, they shall be accepted in the order listed. The low bidder will be determined on the basis of the sum of the Base Bid and the alternates accepted.

11. SUBMISSION OF BIDS

A. The Bid Form shall be properly executed and enclosed with the required bid deposit in a sealed envelope plainly marked on the outside with the following information.

Bid For:

_____

SUBMITTED BY:

_____ _____

(Name of Bidder) (Address of Bidder)

B. If Bids are mailed; the above required envelope shall be enclosed in a second envelope identified with the above markings and mailed to the place of bid opening, as described in the Invitation to Bid. Mailed Bids must be received before the time scheduled for opening of Bids.

12. PERFORMANCE AND PAYMENT BONDS

A. Labor and Materials Payment Bond required of the General Contractor shall be in the amount of 50% of the contract sum from a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and approved by the Owner.

13. FOREIGN CORPORATIONS

A. The attention of bidders is called to General Laws, Chapter 30, Section 39L, as amended by Acts of 1967, Chapter 3, under which the Owner may not enter into a contract with a foreign corporation as a subcontractor unless the foreign corporation has filed with the Owner a certificate by the State Secretary stating that the foreign corporation has complied with General Laws Chapter 181, Sections 3 and 5 and stating the date of such compliance.

14. AWARD OF CONTRACT

A. The Contract will be awarded to the lowest responsible and eligible bidder except in the event of a substitution as provided by under Chapter 149, Sections 44E and 44F of the above-reference General Laws.

15. COMMENCEMENT AND COMPLETION OF WORK

A. The successful bidder, upon completion of the Contract Agreement, shall commence the work of the Contract within seven (7) calendar days from receipt of written Notice to Proceed issued by the Owner within fourteen (14) calendar days after said execution of the Contract Agreement, and shall therefore diligently and continuously carry on the work in such manner as to substantially complete the work as noted herein.

16. LIQUIDATED DAMAGES

A. The attention of bidders is particularly called to the requirements as to the conditions of employment to be observed, the minimum wage rates to be paid under the Contract and affirmative action to ensure equal employment opportunity.

BID FORM

For: Arlington Gateways (Bid #16-42)

Proposal (BID) of _____

(hereinafter called "Bidder") a corporation, organized and existing under the laws of the Commonwealth of Massachusetts.

_____

doing business as _____

(corporation, proprietorship, partnership)

to the TOWN OF ARLINGTON hereinafter called "Owner".

Gentlemen:

A. The Bidder, in compliance with your invitation for bids for Arlington Gateways, Arlington Massachusetts, having examined the plan and specifications with related documents and the site of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this Contract on or before a date to be specified in the written "Notice to Proceed" from the Owner, and to complete the work by June 15, 2017. The Bidder further agrees to pay as liquidated damages, the sum of $100.00 for each consecutive calendar day thereafter that the works remains incomplete, as provided in the Instruction to Bidders, Modifications to General Conditions.

B. Bidder acknowledges receipt of the following addendum:

_____ Dated _____

_____ Dated _____

_____ Dated _____

C. Bidder agrees to perform all work described in the specifications and shown on the drawings, for the following lump sum price of:

1. Total Proposed Base Bid Contract Price:

_____ Dollars ($_____)

2. Alternates
This bid includes Alternates as follows:

ADD Alternate No. 1 (Side Driveway Scope):_____dollars

and_____cents ${_____).

ADD Alternate No. 2 (Concrete Paving in Turnaround):_____dollars

and_____cents ${_____).

D. If the Bid is accepted by the Owner, the undersigned agrees to complete the entire work provided to be done under the contract within the time stipulated by the Owner.

E. The undersigned agrees that for extra work, if any, performed in accordance with the AGREMENT, he will accept compensation as stipulated therein in full payment for such extra work.

F. Bidder understands that the Owner reserves the right to reject any and all bids.

G. The undersigned hereby agrees that he will not withdraw the Bid within thirty (30) consecutive calendar days after the actual date of the opening of Bids and that, if the Owner accepts this Bid, the undersigned will duly execute and acknowledge the required Contract Bonds within 10 days after notification that the AGREEMENT is ready for signature.

H. Should the undersigned fail to fulfill any of his agreements as here in before set forth, the Owner shall have the right to retain as liquidated damages the amount of the Bid security, which shall become the Owner/s property. If a bid was furnished as bid security, it is agreed that the amount thereof shall be paid as liquidated damages to the Owner by the Surety.

I. The Undersigned certifies under penalty of perjury that this Bid is in all respect bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the "person" shall men natural person, joint venture, partnership, corporation or other business or legal entity.

J. The undersigned certifies that he is able to furnish labor that can work in harmony with all with all laws and regulations applicable to awards made subject forty-four A.

1. Have been in business under the present name for_____years.

2. Ever failed to complete any work awarded?_____(Yes),_____(No). If yes, explain: _____

K. The Bidder is required to state below all work he/she and his/her subcontractors (if subcontractors are to perform substantial portions of the work) has compete within the past 5 years of a similar character and value to that of the work included in the proposed Contract and to give references that will enable the Owners to judge the Bidder's experience, skill and business standing. The Bidder is required to list a minimum of 3 completed projects that are comparable in scope, complexity and value. For each project, include the name, location, type, date complete, construction value and owner contact.

_____

_____

_____

_____

_____

_____

_____

(add supplementary page if necessary)

L. The Bidder is required to state below all construction projects he/she currently has under contract. For each project, include the name, location, type, scheduled completion date, construction value and owner contact.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

M. The undersigned bidder hereby certifies that the tools and equipment required to meet the specified requirements of the Contract document, with special attention called to Section 31 00 00 Earthwork, will be utilized in the performance of the work.

N. The undersigned further certifies under the penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provisions of section 29F, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation declared there under.

Date: _____

_____
Name of General Bidder
By:

_____
Name and Title of Person Signing Bond

_____
Business Address

FORM A

CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fir and made without collusion or fraud with any other person. As used in this section the word 'person' shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

_____

Authorized Name

_____

Authorized Signature Date

_____

Social Security Number or Federal Identification Number

_____

Legal Name of Business Entity (Print or Type)

_____

Address

_____

City, State, Zip Code

Corporate Seal (If applicable)

FORM B

CERTIFICATE OF FOREIGN CORPORATION

The undersigned certifies that it has been duly established, organized, or chartered as a corporation under the laws of:

_____

Jurisdiction

The undersigned further certifies that it complies with the requirements of M.G.L, c. 30, sec. 39L and with the requirements of M.G.L, c. 181 relative to the registration and operation of foreign corporations within the Commonwealth of Massachusetts.

_____

Name of Person Signing the Bid or Proposal Date

_____

Signature of Person Signing the Bid or Proposal Date

_____

Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM C

BIDDER CERTIFICATION REGARDING PAYMENT OF PREVAILING WAGES

The undersigned hereby certifies, under pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less that the applicable wage rates established for the project by the Massachusetts Department of Labor and Industries. The undersigned bidder agrees to identify the awarding authority for, from, and against any loss, expense, damages, action, or claims, including any expense incurred in connection with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates or (2) the failure of the bidder, of selected as the contractor, to pay laborers employed on the project the said applying prevailing wage rates.

_____

Date

_____

Name of Person Signing the Bid or Proposal

_____

Signature of Person Signing the Bid or Proposal Title

_____

Name of Business (Print or Type)

Corporate Seal (If applicable)

FORM D

CERTIFICATION OF PAYMENT OF STATE TAXES

Legislation enacted by the Commonwealth of Massachusetts, effective, 1983, requires that attestation below be signed:

Pursuant top M.G.L c. 62C, sec. 49A, I certify under the penalties of perjury, that I,to my best knowledge and belief, have filed all state tax returns and paid all state taxes required by law.

APPROVAL OF A CONTRACT OR ANY OTHER AGREEMENT WILL NOT BE GRANTED UNLESS THIS CERITIFCATION CLAUSE IS SIGNED BY AN AUTHORIZED CORPROATE OFFICER.

THE TAX PAYER IDENTIFICATION NUMBER WILL BE FURNISHED TO THE MASSACHUSETIS DPEARTMENT OF REVENUE TO DETERMINE IF TAX FILINGS AND/OR TAX PAYMENT OBLIGATIONS HAVE BEEN MET. PROVIDERS WHO FAIL TO CORRECT THIER NON-FILING AND/OR DELIQUENCY STATUS SHALL NOT HAVE A CONTRACT OR ANY OTHER AGREEMENT ISSUED, RENEWED OR EXTENDED

_____

(Signature of Individual) Title

_____

Social Security Number or Federal Identification Number

_____

Corporate Name

_____

Name of Person Signing the Proposal (Print or Type) Date

_____

Legal Name of Business Entity (Print or Type)

_____

Business Address

Corporate Seal (If applicable)

To view and print Weekly Payroll & Statement of Compliance Forms, click on www.mass.gov/dols/pw.

PLEASE NOTE: The attached Prevailing Wage Schedule is valid for 90 days. An Awarding Authority should re-request an up to date Prevailing Wage Schedule if it has NOT opened bids or selected a contractor within 90 days of the issuance date of the attached prevailing wage schedule.

*For MULTI-YEAR projects bid on or after 8/8/08, Awarding Authorities must request an Annual Update to this Prevailing Wage Schedule each year for the duration of the project, no later than two weeks before the anniversary date of the execution of the general contract. Annual updates are not required for projects that last LESS THAN ONE YEAR.

*For CM AT RISK projects (bid pursuant to GL c.149A), Awarding Authorities must request a Prevailing Wage Schedule NOT sooner than 90-days before the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work.

*For MULTI-YEAR CM AT RISK projects, Awarding Authorities must request an Annual Update to this Prevailing Wage Schedule each year for the duration of the project, no later than two weeks before the anniversary date, which is the earlier of: (a)the execution date of the GMP Amendment, or (b) the execution date of the first amendment to procure construction scopes of work.

Apprentice wages (expressed as dollar figures) and the required benefits are listed on the Prevailing Wage Schedule. For further details, please see opinion letter PW-2010-03-03.16.10 (dated March 18, 2010) at www.mass.gov/dols/pw.

Request Prevailing Wage Rates online at: www.mass.gov/dols/pw.

THIS IS A SYSTEM-GENERATED EMAIL. PLEASE DO NOT REPLY TO THIS EMAIL. TO CONTACT DLS REGARDING PREVAILING WAGE MATTERS, CALL 617-626-6953.
==========

APPROVAL/DENIAL COMMENTS

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

RONALD L. WALKER, II
Secretary

WILLIAM D MCKINNEY
Director

Awarding Authority: Town of Arlington

Contract Number: 17-30 **City/Town:** ARLINGTON

Description of Work: Driveway Reconstruction at the Central School Building per specifications and requirements

Job Location: Academy Street

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.
- An Awarding Authority 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. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- 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. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for 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 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 Department of Labor Standards, Division of Apprentice Standards (DLS/DAS). Apprentice must keep his/her apprentice identification card on his/her person during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DLS/DAS regardless of whether or not they are registered with any other federal, state, local, or private agency 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. For multi-year CM AT RISK projects, awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. 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 and a Statement of Compliance directly to the awarding authority by mail or email 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

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2016	$33.25	$10.91	$10.89	$0.00	$55.05
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2016	$33.32	$10.91	$10.89	$0.00	$55.12
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2016	$33.44	$10.91	$10.89	$0.00	$55.24
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$88.29	$9.80	$19.23	$0.00	$117.32
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR *LABORERS - ZONE 1*	12/01/2016	$37.10	$7.60	$14.15	$0.00	$58.85
	06/01/2017	$38.10	$7.60	$14.15	$0.00	$59.85
	12/01/2017	$38.95	$7.60	$14.15	$0.00	$60.70
	06/01/2018	$39.90	$7.60	$14.15	$0.00	$61.65
	12/01/2018	$40.85	$7.60	$14.15	$0.00	$62.60
	06/01/2019	$41.85	$7.60	$14.15	$0.00	$63.60
	12/01/2019	$42.85	$7.60	$14.15	$0.00	$64.60
For apprentice rates see "Apprentice- LABORER"						
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2016	$33.90	$11.50	$7.10	$0.00	$52.50
	06/01/2017	$34.90	$11.50	$7.10	$0.00	$53.50
	12/01/2017	$35.90	$11.50	$7.10	$0.00	$54.50
	06/01/2018	$36.90	$11.50	$7.10	$0.00	$55.50
	12/01/2018	$37.90	$11.50	$7.10	$0.00	$56.50
	06/01/2019	$38.90	$11.50	$7.10	$0.00	$57.50
	12/01/2019	$39.90	$11.50	$7.10	$0.00	$58.50
	06/01/2020	$40.90	$11.50	$7.10	$0.00	$59.50
	12/01/2020	$41.90	$11.50	$7.10	$0.00	$60.50
ASPHALT RAKER *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$45.38	$10.00	$15.25	$0.00	$70.63
	06/01/2017	$46.38	$10.00	$15.25	$0.00	$71.63
	12/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$45.38	$10.00	$15.25	$0.00	$70.63
	06/01/2017	$46.38	$10.00	$15.25	$0.00	$71.63
	12/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 1*	12/01/2016	$37.10	$7.60	$14.15	$0.00	$58.85
	06/01/2017	$38.10	$7.60	$14.15	$0.00	$59.85
	12/01/2017	$38.95	$7.60	$14.15	$0.00	$60.70
	06/01/2018	$39.90	$7.60	$14.15	$0.00	$61.65
	12/01/2018	$40.85	$7.60	$14.15	$0.00	$62.60
	06/01/2019	$41.85	$7.60	$14.15	$0.00	$63.60
	12/01/2019	$42.85	$7.60	$14.15	$0.00	$64.60
For apprentice rates see "Apprentice- LABORER"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2017	$42.92	$6.97	$16.21	$0.00	$66.10

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$27.90	$6.97	$10.54	$0.00	$45.41
2	65	$27.90	$6.97	$10.54	$0.00	$45.41
3	70	$30.04	$6.97	$11.35	$0.00	$48.36
4	75	$32.19	$6.97	$12.16	$0.00	$51.32
5	80	$34.34	$6.97	$12.97	$0.00	$54.28
6	85	$36.48	$6.97	$13.78	$0.00	$57.23
7	90	$38.63	$6.97	$14.59	$0.00	$60.19
8	95	$40.77	$6.97	$15.40	$0.00	$63.14

Notes:

Apprentice to Journeyworker Ratio:1:5

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (BOSTON)*	03/01/2017	$50.76	$10.75	$19.22	$0.00	$80.73

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Boston*

Effective Date - 03/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.38	$10.75	$19.22	$0.00	$55.35
2	60	$30.46	$10.75	$19.22	$0.00	$60.43
3	70	$35.53	$10.75	$19.22	$0.00	$65.50
4	80	$40.61	$10.75	$19.22	$0.00	$70.58
5	90	$45.68	$10.75	$19.22	$0.00	$75.65

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2016	$37.45	$7.60	$14.35	$0.00	$59.40
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2016	$36.30	$7.60	$14.35	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2016	$36.30	$7.60	$14.35	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	03/01/2017	$38.77	$9.90	$17.00	$0.00	$65.67
	09/01/2017	$39.78	$9.90	$17.00	$0.00	$66.68
	03/01/2018	$40.78	$9.90	$17.00	$0.00	$67.68
	09/01/2018	$41.82	$9.90	$17.00	$0.00	$68.72
	03/01/2019	$42.85	$9.90	$17.00	$0.00	$69.75

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 03/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.39	$9.90	$1.63	$0.00	$30.92
2	60	$23.26	$9.90	$1.63	$0.00	$34.79
3	70	$27.14	$9.90	$12.11	$0.00	$49.15
4	75	$29.08	$9.90	$12.11	$0.00	$51.09
5	80	$31.02	$9.90	$13.74	$0.00	$54.66
6	80	$31.02	$9.90	$13.74	$0.00	$54.66
7	90	$34.89	$9.90	$15.37	$0.00	$60.16
8	90	$34.89	$9.90	$15.37	$0.00	$60.16

Effective Date - 09/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.89	$9.90	$1.63	$0.00	$31.42
2	60	$23.87	$9.90	$1.63	$0.00	$35.40
3	70	$27.85	$9.90	$12.11	$0.00	$49.86
4	75	$29.84	$9.90	$12.11	$0.00	$51.85
5	80	$31.82	$9.90	$13.74	$0.00	$55.46
6	80	$31.82	$9.90	$13.74	$0.00	$55.46
7	90	$35.80	$9.90	$15.37	$0.00	$61.07
8	90	$35.80	$9.90	$15.37	$0.00	$61.07

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (BOSTON)*	01/01/2017	$45.67	$12.20	$19.41	$1.30	$78.58
	07/01/2017	$46.30	$12.20	$19.41	$1.30	$79.21
	01/01/2018	$46.54	$12.20	$19.41	$1.30	$79.45
	07/01/2018	$46.79	$12.20	$19.41	$1.30	$79.70
	01/01/2019	$47.03	$12.20	$19.41	$1.30	$79.94
	07/01/2019	$47.27	$12.20	$19.41	$1.30	$80.18
	01/01/2020	$47.52	$12.20	$19.41	$1.30	$80.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CEMENT MASONRY/PLASTERING - Eastern Mass (Boston)*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.84	$12.20	$12.41	$0.00	$47.45
2	60	$27.40	$12.20	$14.41	$1.30	$55.31
3	65	$29.69	$12.20	$15.41	$1.30	$58.60
4	70	$31.97	$12.20	$16.41	$1.30	$61.88
5	75	$34.25	$12.20	$17.41	$1.30	$65.16
6	80	$36.54	$12.20	$18.41	$1.30	$68.45
7	90	$41.10	$12.20	$19.41	$1.30	$74.01

Effective Date - 07/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.15	$12.20	$12.41	$0.00	$47.76
2	60	$27.78	$12.20	$14.41	$1.30	$55.69
3	65	$30.10	$12.20	$15.41	$1.30	$59.01
4	70	$32.41	$12.20	$16.41	$1.30	$62.32
5	75	$34.73	$12.20	$17.41	$1.30	$65.64
6	80	$37.04	$12.20	$18.41	$1.30	$68.95
7	90	$41.67	$12.20	$19.41	$1.30	$74.58

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 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$46.38	$10.00	$15.25	$0.00	$71.63
	06/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63
	12/01/2017	$48.38	$10.00	$15.25	$0.00	$73.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$31.17	$10.00	$15.25	$0.00	$56.42
	06/01/2017	$31.86	$10.00	$15.25	$0.00	$57.11
	12/01/2017	$32.55	$10.00	$15.25	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	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 - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.71	$7.85	$0.00	$0.00	$33.56
2	55	$28.28	$7.85	$3.66	$0.00	$39.79
3	60	$30.85	$7.85	$3.99	$0.00	$42.69
4	65	$33.42	$7.85	$4.32	$0.00	$45.59
5	70	$35.99	$7.85	$14.11	$0.00	$57.95
6	75	$38.56	$7.85	$14.44	$0.00	$60.85
7	80	$41.13	$7.85	$14.77	$0.00	$63.75
8	90	$46.27	$7.85	$15.44	$0.00	$69.56

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 1*	12/01/2016	$36.50	$7.60	$14.15	$0.00	$58.25
	06/01/2017	$37.50	$7.60	$14.15	$0.00	$59.25
	12/01/2017	$38.35	$7.60	$14.15	$0.00	$60.10
	06/01/2018	$39.30	$7.60	$14.15	$0.00	$61.05
	12/01/2018	$40.25	$7.60	$14.15	$0.00	$62.00
	06/01/2019	$41.25	$7.60	$14.15	$0.00	$63.00
	12/01/2019	$42.25	$7.60	$14.15	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 1*	12/01/2016	$37.50	$7.60	$14.15	$0.00	$59.25
	06/01/2017	$38.50	$7.60	$14.15	$0.00	$60.25
	12/01/2017	$39.35	$7.60	$14.15	$0.00	$61.10
	06/01/2018	$40.30	$7.60	$14.15	$0.00	$62.05
	12/01/2018	$41.25	$7.60	$14.15	$0.00	$63.00
	06/01/2019	$42.25	$7.60	$14.15	$0.00	$64.00
	12/01/2019	$43.25	$7.60	$14.15	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 1*	12/01/2016	$37.25	$7.60	$14.15	$0.00	$59.00
	06/01/2017	$38.25	$7.60	$14.15	$0.00	$60.00
	12/01/2017	$39.10	$7.60	$14.15	$0.00	$60.85
	06/01/2018	$40.05	$7.60	$14.15	$0.00	$61.80
	12/01/2018	$41.00	$7.60	$14.15	$0.00	$62.75
	06/01/2019	$42.00	$7.60	$14.15	$0.00	$63.75
	12/01/2019	$43.00	$7.60	$14.15	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 1*	12/01/2016	$37.50	$7.60	$14.15	$0.00	$59.25
	06/01/2017	$38.50	$7.60	$14.15	$0.00	$60.25
	12/01/2017	$39.35	$7.60	$14.15	$0.00	$61.10
	06/01/2018	$40.30	$7.60	$14.15	$0.00	$62.05
	12/01/2018	$41.25	$7.60	$14.15	$0.00	$63.00
	06/01/2019	$42.25	$7.60	$14.15	$0.00	$64.00
	12/01/2019	$43.25	$7.60	$14.15	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 1*	12/01/2016	$37.25	$7.60	$14.15	$0.00	$59.00
	06/01/2017	$38.25	$7.60	$14.15	$0.00	$60.00
	12/01/2017	$39.10	$7.60	$14.15	$0.00	$60.85
	06/01/2018	$40.05	$7.60	$14.15	$0.00	$61.80
	12/01/2018	$41.00	$7.60	$14.15	$0.00	$62.75
	06/01/2019	$42.00	$7.60	$14.15	$0.00	$63.75
	12/01/2019	$43.00	$7.60	$14.15	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 1*	12/01/2016	$36.50	$7.60	$14.15	$0.00	$58.25
	06/01/2017	$37.50	$7.60	$14.15	$0.00	$59.25
	12/01/2017	$38.35	$7.60	$14.15	$0.00	$60.10
	06/01/2018	$39.30	$7.60	$14.15	$0.00	$61.05
	12/01/2018	$40.25	$7.60	$14.15	$0.00	$62.00
	06/01/2019	$41.25	$7.60	$14.15	$0.00	$63.00
	12/01/2019	$42.25	$7.60	$14.15	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$58.86	$9.80	$19.23	$0.00	$87.89
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$63.06	$9.80	$19.23	$0.00	$92.09
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$88.23	$9.80	$19.23	$0.00	$117.26
For apprentice rates see "Apprentice- PILE DRIVER"						
DRAWBRIDGE OPERATOR (Construction) *ELECTRICIANS LOCAL 103*	03/01/2017	$48.33	$13.00	$17.45	$0.00	$78.78
	09/01/2017	$49.28	$13.00	$17.48	$0.00	$79.76
	03/01/2018	$50.48	$13.00	$17.51	$0.00	$80.99
	09/01/2018	$51.67	$13.00	$17.55	$0.00	$82.22
	03/01/2019	$52.87	$13.00	$17.59	$0.00	$83.46
For apprentice rates see "Apprentice- ELECTRICIAN"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ELECTRICIAN *ELECTRICIANS LOCAL 103*	03/01/2017	$48.33	$13.00	$17.45	$0.00	$78.78
	09/01/2017	$49.28	$13.00	$17.48	$0.00	$79.76
	03/01/2018	$50.48	$13.00	$17.51	$0.00	$80.99
	09/01/2018	$51.67	$13.00	$17.55	$0.00	$82.22
	03/01/2019	$52.87	$13.00	$17.59	$0.00	$83.46

Apprentice - *ELECTRICIAN - Local 103*

Effective Date - 03/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$19.33	$13.00	$0.58	$0.00	$32.91
2	40	$19.33	$13.00	$0.58	$0.00	$32.91
3	45	$21.75	$13.00	$13.37	$0.00	$48.12
4	45	$21.75	$13.00	$13.37	$0.00	$48.12
5	50	$24.17	$13.00	$13.75	$0.00	$50.92
6	55	$26.58	$13.00	$14.11	$0.00	$53.69
7	60	$29.00	$13.00	$14.48	$0.00	$56.48
8	65	$31.41	$13.00	$14.85	$0.00	$59.26
9	70	$33.83	$13.00	$15.22	$0.00	$62.05
10	75	$36.25	$13.00	$15.60	$0.00	$64.85

Effective Date - 09/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$19.71	$13.00	$0.59	$0.00	$33.30
2	40	$19.71	$13.00	$0.59	$0.00	$33.30
3	45	$22.18	$13.00	$13.39	$0.00	$48.57
4	45	$22.18	$13.00	$13.39	$0.00	$48.57
5	50	$24.64	$13.00	$13.76	$0.00	$51.40
6	55	$27.10	$13.00	$14.12	$0.00	$54.22
7	60	$29.57	$13.00	$14.50	$0.00	$57.07
8	65	$32.03	$13.00	$14.87	$0.00	$59.90
9	70	$34.50	$13.00	$15.25	$0.00	$62.75
10	75	$36.96	$13.00	$15.62	$0.00	$65.58

Notes: :
App Prior 1/1/03; 30/35/40/45/50/55/65/70/75/80

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2017	$55.86	$15.28	$15.71	$0.00	$86.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.93	$15.28	$0.00	$0.00	$43.21
2	55	$30.72	$15.28	$15.71	$0.00	$61.71
3	65	$36.31	$15.28	$15.71	$0.00	$67.30
4	70	$39.10	$15.28	$15.71	$0.00	$70.09
5	80	$44.69	$15.28	$15.71	$0.00	$75.68

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*	01/01/2017	$39.10	$15.28	$15.71	$0.00	$70.09
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"						
FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2017	$42.15	$10.00	$15.25	$0.00	$67.40
	11/01/2017	$42.88	$10.00	$15.25	$0.00	$68.13
	05/01/2018	$43.59	$10.00	$15.25	$0.00	$68.84
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2017	$43.61	$10.00	$15.25	$0.00	$68.86
	11/01/2017	$44.34	$10.00	$15.25	$0.00	$69.59
	05/01/2018	$45.06	$10.00	$15.25	$0.00	$70.31
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2017	$22.41	$10.00	$15.25	$0.00	$47.66
	11/01/2017	$22.83	$10.00	$15.25	$0.00	$48.08
	05/01/2018	$23.26	$10.00	$15.25	$0.00	$48.51
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 103*	03/01/2017	$48.33	$13.00	$17.45	$0.00	$78.78
	09/01/2017	$49.28	$13.00	$17.48	$0.00	$79.76
	03/01/2018	$50.48	$13.00	$17.51	$0.00	$80.99
	09/01/2018	$51.67	$13.00	$17.55	$0.00	$82.22
	03/01/2019	$52.87	$13.00	$17.59	$0.00	$83.46
For apprentice rates see "Apprentice- ELECTRICIAN"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING *ELECTRICIANS LOCAL 103*	03/01/2017	$36.25	$13.00	$15.60	$0.00	$64.85
	09/01/2017	$36.96	$13.00	$15.62	$0.00	$65.58
	03/01/2018	$37.86	$13.00	$15.65	$0.00	$66.51
	09/01/2018	$38.75	$13.00	$15.67	$0.00	$67.42
	03/01/2019	$39.65	$13.00	$15.70	$0.00	$68.35
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$37.65	$10.00	$15.25	$0.00	$62.90
	06/01/2017	$38.49	$10.00	$15.25	$0.00	$63.74
	12/01/2017	$39.32	$10.00	$15.25	$0.00	$64.57
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 1*	12/01/2016	$20.50	$7.60	$14.15	$0.00	$42.25
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE I*	03/01/2016	$42.13	$9.80	$17.62	$0.00	$69.55

Apprentice - *FLOORCOVERER - Local 2168 Zone I*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.07	$9.80	$1.79	$0.00	$32.66
2	55	$23.17	$9.80	$1.79	$0.00	$34.76
3	60	$25.28	$9.80	$12.25	$0.00	$47.33
4	65	$27.38	$9.80	$12.25	$0.00	$49.43
5	70	$29.49	$9.80	$14.04	$0.00	$53.33
6	75	$31.60	$9.80	$14.04	$0.00	$55.44
7	80	$33.70	$9.80	$15.83	$0.00	$59.33
8	85	$35.81	$9.80	$15.83	$0.00	$61.44

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$45.38	$10.00	$15.25	$0.00	$70.63
	06/01/2017	$46.38	$10.00	$15.25	$0.00	$71.63
	12/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$31.17	$10.00	$15.25	$0.00	$56.42
	06/01/2017	$31.86	$10.00	$15.25	$0.00	$57.11
	12/01/2017	$32.55	$10.00	$15.25	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	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 - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.46	$7.85	$0.00	$0.00	$28.31
2	55	$22.50	$7.85	$3.66	$0.00	$34.01
3	60	$24.55	$7.85	$3.99	$0.00	$36.39
4	65	$26.59	$7.85	$4.32	$0.00	$38.76
5	70	$28.64	$7.85	$14.11	$0.00	$50.60
6	75	$30.68	$7.85	$14.44	$0.00	$52.97
7	80	$32.73	$7.85	$14.77	$0.00	$55.35
8	90	$36.82	$7.85	$15.44	$0.00	$60.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$45.38	$10.00	$15.25	$0.00	$70.63
	06/01/2017	$46.38	$10.00	$15.25	$0.00	$71.63
	12/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$24.96	$10.00	$0.00	$0.00	$34.96
2	60	$27.23	$10.00	$15.25	$0.00	$52.48
3	65	$29.50	$10.00	$15.25	$0.00	$54.75
4	70	$31.77	$10.00	$15.25	$0.00	$57.02
5	75	$34.04	$10.00	$15.25	$0.00	$59.29
6	80	$36.30	$10.00	$15.25	$0.00	$61.55
7	85	$38.57	$10.00	$15.25	$0.00	$63.82
8	90	$40.84	$10.00	$15.25	$0.00	$66.09

Effective Date - 06/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$25.51	$10.00	$0.00	$0.00	$35.51
2	60	$27.83	$10.00	$15.25	$0.00	$53.08
3	65	$30.15	$10.00	$15.25	$0.00	$55.40
4	70	$32.47	$10.00	$15.25	$0.00	$57.72
5	75	$34.79	$10.00	$15.25	$0.00	$60.04
6	80	$37.10	$10.00	$15.25	$0.00	$62.35
7	85	$39.42	$10.00	$15.25	$0.00	$64.67
8	90	$41.74	$10.00	$15.25	$0.00	$66.99

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2017	$43.72	$11.45	$23.07	$2.35	$80.59
	08/01/2017	$44.82	$11.45	$23.07	$2.35	$81.69
	02/01/2018	$45.97	$11.45	$23.07	$2.35	$82.84
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 103*	03/01/2017	$48.33	$13.00	$17.45	$0.00	$78.78
	09/01/2017	$49.28	$13.00	$17.48	$0.00	$79.76
	03/01/2018	$50.48	$13.00	$17.51	$0.00	$80.99
	09/01/2018	$51.67	$13.00	$17.55	$0.00	$82.22
	03/01/2019	$52.87	$13.00	$17.59	$0.00	$83.46
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2017	$43.72	$11.45	$23.07	$2.35	$80.59
	08/01/2017	$44.82	$11.45	$23.07	$2.35	$81.69
	02/01/2018	$45.97	$11.45	$23.07	$2.35	$82.84
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PIPEFITTERS LOCAL 537*	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC *PIPEFITTERS LOCAL 537*	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS *LABORERS - ZONE 1*	12/01/2016	$37.10	$7.60	$14.15	$0.00	$58.85
	06/01/2017	$38.10	$7.60	$14.15	$0.00	$59.85
	12/01/2017	$38.95	$7.60	$14.15	$0.00	$60.70
	06/01/2018	$39.90	$7.60	$14.15	$0.00	$61.65
	12/01/2018	$40.85	$7.60	$14.15	$0.00	$62.60
	06/01/2019	$41.85	$7.60	$14.15	$0.00	$63.60
	12/01/2019	$42.85	$7.60	$14.15	$0.00	$64.60
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2016	$45.09	$11.75	$14.20	$0.00	$71.04
	09/01/2017	$47.09	$11.75	$14.20	$0.00	$73.04
	09/01/2018	$49.34	$11.75	$14.20	$0.00	$75.29
	09/01/2019	$51.84	$11.75	$14.20	$0.00	$77.79

Apprentice - *ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston*

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.55	$11.75	$10.45	$0.00	$44.75
2	60	$27.05	$11.75	$11.20	$0.00	$50.00
3	70	$31.56	$11.75	$11.95	$0.00	$55.26
4	80	$36.07	$11.75	$12.70	$0.00	$60.52

Effective Date - 09/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.55	$11.75	$10.45	$0.00	$45.75
2	60	$28.25	$11.75	$11.20	$0.00	$51.20
3	70	$32.96	$11.75	$11.95	$0.00	$56.66
4	80	$37.67	$11.75	$12.70	$0.00	$62.12

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (BOSTON AREA)*	03/16/2017	$44.65	$7.80	$20.85	$0.00	$73.30

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Boston*

Effective Date - 03/16/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.79	$7.80	$20.85	$0.00	$55.44
2	70	$31.26	$7.80	$20.85	$0.00	$59.91
3	75	$33.49	$7.80	$20.85	$0.00	$62.14
4	80	$35.72	$7.80	$20.85	$0.00	$64.37
5	85	$37.95	$7.80	$20.85	$0.00	$66.60
6	90	$40.19	$7.80	$20.85	$0.00	$68.84

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 1*	12/01/2016	$36.35	$7.60	$14.15	$0.00	$58.10
	06/01/2017	$37.35	$7.60	$14.15	$0.00	$59.10
	12/01/2017	$38.20	$7.60	$14.15	$0.00	$59.95
	06/01/2018	$39.15	$7.60	$14.15	$0.00	$60.90
	12/01/2018	$40.10	$7.60	$14.15	$0.00	$61.85
	06/01/2019	$41.10	$7.60	$14.15	$0.00	$62.85
	12/01/2019	$42.10	$7.60	$14.15	$0.00	$63.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER - Zone 1*

Effective Date - 12/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$21.81	$7.60	$14.15	$0.00	$43.56
2	70	$25.45	$7.60	$14.15	$0.00	$47.20
3	80	$29.08	$7.60	$14.15	$0.00	$50.83
4	90	$32.72	$7.60	$14.15	$0.00	$54.47

Effective Date - 06/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$22.41	$7.60	$14.15	$0.00	$44.16
2	70	$26.15	$7.60	$14.15	$0.00	$47.90
3	80	$29.88	$7.60	$14.15	$0.00	$51.63
4	90	$33.62	$7.60	$14.15	$0.00	$55.37

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 1*	12/01/2016	$36.35	$7.60	$14.15	$0.00	$58.10
	06/01/2017	$37.35	$7.60	$14.15	$0.00	$59.10
	12/01/2017	$38.20	$7.60	$14.15	$0.00	$59.95
	06/01/2018	$39.15	$7.60	$14.15	$0.00	$60.90
	12/01/2018	$40.10	$7.60	$14.15	$0.00	$61.85
	06/01/2019	$41.10	$7.60	$14.15	$0.00	$62.85
	12/01/2019	$42.10	$7.60	$14.15	$0.00	$63.85
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 1*	12/01/2016	$36.35	$7.60	$14.15	$0.00	$58.10
	06/01/2017	$37.35	$7.60	$14.15	$0.00	$59.10
	12/01/2017	$38.20	$7.60	$14.15	$0.00	$59.95
	06/01/2018	$39.15	$7.60	$14.15	$0.00	$60.90
	12/01/2018	$40.10	$7.60	$14.15	$0.00	$61.85
	06/01/2019	$41.10	$7.60	$14.15	$0.00	$62.85
	12/01/2019	$42.10	$7.60	$14.15	$0.00	$63.85
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 1*	12/01/2016	$36.50	$7.60	$14.15	$0.00	$58.25
	06/01/2017	$37.50	$7.60	$14.15	$0.00	$59.25
	12/01/2017	$38.35	$7.60	$14.15	$0.00	$60.10
	06/01/2018	$39.30	$7.60	$14.15	$0.00	$61.05
	12/01/2018	$40.25	$7.60	$14.15	$0.00	$62.00
	06/01/2019	$41.25	$7.60	$14.15	$0.00	$63.00
	12/01/2019	$42.28	$7.60	$14.15	$0.00	$64.03
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: MASON TENDER *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 1*	12/01/2016	$36.35	$7.60	$14.15	$0.00	$58.10
	06/01/2017	$37.35	$7.60	$14.15	$0.00	$59.10
	12/01/2017	$38.20	$7.60	$14.15	$0.00	$59.95
	06/01/2018	$39.15	$7.60	$14.15	$0.00	$60.90
	12/01/2018	$40.10	$7.60	$14.15	$0.00	$61.85
	06/01/2019	$41.10	$7.60	$14.15	$0.00	$62.85
	12/01/2019	$42.10	$7.60	$14.15	$0.00	$63.85
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 1*	12/01/2016	$36.35	$7.60	$14.15	$0.00	$58.10
	06/01/2017	$37.35	$7.60	$14.15	$0.00	$59.10
	12/01/2017	$38.20	$7.60	$14.15	$0.00	$59.95
	06/01/2018	$39.15	$7.60	$14.15	$0.00	$60.90
	12/01/2018	$40.10	$7.60	$14.15	$0.00	$61.85
	06/01/2019	$41.10	$7.60	$14.15	$0.00	$62.85
	12/01/2019	$42.10	$7.60	$14.15	$0.00	$63.85
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 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2017	$38.78	$10.75	$17.67	$0.00	$67.20

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MARBLE & TILE FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.39	$10.75	$17.67	$0.00	$47.81
2	60	$23.27	$10.75	$17.67	$0.00	$51.69
3	70	$27.15	$10.75	$17.67	$0.00	$55.57
4	80	$31.02	$10.75	$17.67	$0.00	$59.44
5	90	$34.90	$10.75	$17.67	$0.00	$63.32

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2017	$50.80	$10.75	$19.22	$0.00	$80.77

Apprentice - *MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile*

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.40	$10.75	$19.22	$0.00	$55.37
2	60	$30.48	$10.75	$19.22	$0.00	$60.45
3	70	$35.56	$10.75	$19.22	$0.00	$65.53
4	80	$40.64	$10.75	$19.22	$0.00	$70.61
5	90	$45.72	$10.75	$19.22	$0.00	$75.69

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 1) *MILLWRIGHTS LOCAL 1121 - Zone 1*	04/01/2017	$38.62	$9.90	$18.50	$0.00	$67.02
	10/01/2017	$39.52	$9.90	$18.50	$0.00	$67.92
	04/01/2018	$40.42	$9.90	$18.50	$0.00	$68.82
	10/01/2018	$41.32	$9.90	$18.50	$0.00	$69.72
	04/01/2019	$42.22	$9.90	$18.50	$0.00	$70.62

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 1*

Effective Date - 04/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$21.24	$9.90	$5.31	$0.00	$36.45
2	65	$25.10	$9.90	$15.13	$0.00	$50.13
3	75	$28.97	$9.90	$16.10	$0.00	$54.97
4	85	$32.83	$9.90	$17.06	$0.00	$59.79

Effective Date - 10/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$21.74	$9.90	$5.31	$0.00	$36.95
2	65	$25.69	$9.90	$15.13	$0.00	$50.72
3	75	$29.64	$9.90	$16.10	$0.00	$55.64
4	85	$33.59	$9.90	$17.06	$0.00	$60.55

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$22.96	$10.00	$15.25	$0.00	$48.21
	06/01/2017	$23.47	$10.00	$15.25	$0.00	$48.72
	12/01/2017	$23.99	$10.00	$15.25	$0.00	$49.24
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$26.94	$10.00	$15.25	$0.00	$52.19
	06/01/2017	$27.54	$10.00	$15.25	$0.00	$52.79
	12/01/2017	$28.15	$10.00	$15.25	$0.00	$53.40
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	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 - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.71	$7.85	$0.00	$0.00	$33.56
2	55	$28.28	$7.85	$3.66	$0.00	$39.79
3	60	$30.85	$7.85	$3.99	$0.00	$42.69
4	65	$33.42	$7.85	$4.32	$0.00	$45.59
5	70	$35.99	$7.85	$14.11	$0.00	$57.95
6	75	$38.56	$7.85	$14.44	$0.00	$60.85
7	80	$41.13	$7.85	$14.77	$0.00	$63.75
8	90	$46.27	$7.85	$15.44	$0.00	$69.56

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) * 01/01/2017 $42.31 $7.85 $16.10 $0.00 $66.26
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - New*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.16	$7.85	$0.00	$0.00	$29.01
2	55	$23.27	$7.85	$3.66	$0.00	$34.78
3	60	$25.39	$7.85	$3.99	$0.00	$37.23
4	65	$27.50	$7.85	$4.32	$0.00	$39.67
5	70	$29.62	$7.85	$14.11	$0.00	$51.58
6	75	$31.73	$7.85	$14.44	$0.00	$54.02
7	80	$33.85	$7.85	$14.77	$0.00	$56.47
8	90	$38.08	$7.85	$15.44	$0.00	$61.37

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) 01/01/2017 $40.37 $7.85 $16.10 $0.00 $64.32
PAINTERS LOCAL 35 - ZONE 2

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.19	$7.85	$0.00	$0.00	$28.04
2	55	$22.20	$7.85	$3.66	$0.00	$33.71
3	60	$24.22	$7.85	$3.99	$0.00	$36.06
4	65	$26.24	$7.85	$4.32	$0.00	$38.41
5	70	$28.26	$7.85	$14.11	$0.00	$50.22
6	75	$30.28	$7.85	$14.44	$0.00	$52.57
7	80	$32.30	$7.85	$14.77	$0.00	$54.92
8	90	$36.33	$7.85	$15.44	$0.00	$59.62

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 1*	12/01/2016	$36.35	$7.60	$14.15	$0.00	$58.10
	06/01/2017	$37.35	$7.60	$14.15	$0.00	$59.10
	12/01/2017	$38.20	$7.60	$14.15	$0.00	$59.95
	06/01/2018	$39.15	$7.60	$14.15	$0.00	$60.90
	12/01/2018	$40.10	$7.60	$14.15	$0.00	$61.85
	06/01/2019	$41.10	$7.60	$14.15	$0.00	$62.85
	12/01/2019	$42.10	$7.60	$14.15	$0.00	$63.85
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*	01/01/2017	$40.91	$7.85	$16.10	$0.00	$64.86

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.46	$7.85	$0.00	$0.00	$28.31
2	55	$22.50	$7.85	$3.66	$0.00	$34.01
3	60	$24.55	$7.85	$3.99	$0.00	$36.39
4	65	$26.59	$7.85	$4.32	$0.00	$38.76
5	70	$28.64	$7.85	$14.11	$0.00	$50.60
6	75	$30.68	$7.85	$14.44	$0.00	$52.97
7	80	$32.73	$7.85	$14.77	$0.00	$55.35
8	90	$36.82	$7.85	$15.44	$0.00	$60.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2017	$38.97	$7.85	$16.10	$0.00	$62.92

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.49	$7.85	$0.00	$0.00	$27.34
2	55	$21.43	$7.85	$3.66	$0.00	$32.94
3	60	$23.38	$7.85	$3.99	$0.00	$35.22
4	65	$25.33	$7.85	$4.32	$0.00	$37.50
5	70	$27.28	$7.85	$14.11	$0.00	$49.24
6	75	$29.23	$7.85	$14.44	$0.00	$51.52
7	80	$31.18	$7.85	$14.77	$0.00	$53.80
8	90	$35.07	$7.85	$15.44	$0.00	$58.36

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2016	$33.08	$10.91	$10.89	$0.00	$54.88
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07

Apprentice - *PILE DRIVER - Local 56 Zone 1*

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.02	$9.80	$19.23	$0.00	$50.05
2	60	$25.22	$9.80	$19.23	$0.00	$54.25
3	70	$29.43	$9.80	$19.23	$0.00	$58.46
4	75	$31.53	$9.80	$19.23	$0.00	$60.56
5	80	$33.63	$9.80	$19.23	$0.00	$62.66
6	80	$33.63	$9.80	$19.23	$0.00	$62.66
7	90	$37.84	$9.80	$19.23	$0.00	$66.87
8	90	$37.84	$9.80	$19.23	$0.00	$66.87

Notes:

Apprentice to Journeyworker Ratio:1:3

PIPEFITTER & STEAMFITTER *PIPEFITTERS LOCAL 537*	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PIPEFITTER - Local 537*

Effective Date - 03/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$20.48	$9.70	$7.50	$0.00	$37.68
2	45	$23.04	$9.70	$18.14	$0.00	$50.88
3	60	$30.71	$9.70	$18.14	$0.00	$58.55
4	70	$35.83	$9.70	$18.14	$0.00	$63.67
5	80	$40.95	$9.70	$18.14	$0.00	$68.79

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:**

PIPELAYER *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10

For apprentice rates see "Apprentice- LABORER"

PLUMBERS & GASFITTERS *PLUMBERS & GASFITTERS LOCAL 12*	03/01/2017	$52.69	$11.32	$15.46	$0.00	$79.47

Apprentice - *PLUMBER/GASFITTER - Local 12*

Effective Date - 03/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$18.44	$11.32	$5.74	$0.00	$35.50
2	40	$21.08	$11.32	$6.49	$0.00	$38.89
3	55	$28.98	$11.32	$8.73	$0.00	$49.03
4	65	$34.25	$11.32	$10.23	$0.00	$55.80
5	75	$39.52	$11.32	$11.72	$0.00	$62.56

Notes:

** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr

Step4 with lic$58.50 Step5 with lic$65.36

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) *PIPEFITTERS LOCAL 537*	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03

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 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER *LABORERS - ZONE 1*	12/01/2016	$37.35	$7.60	$14.15	$0.00	$59.10
	06/01/2017	$38.35	$7.60	$14.15	$0.00	$60.10
	12/01/2017	$39.20	$7.60	$14.15	$0.00	$60.95
	06/01/2018	$40.15	$7.60	$14.15	$0.00	$61.90
	12/01/2018	$41.10	$7.60	$14.15	$0.00	$62.85
	06/01/2019	$42.10	$7.60	$14.15	$0.00	$63.85
	12/01/2019	$43.10	$7.60	$14.15	$0.00	$64.85
For apprentice rates see "Apprentice- LABORER"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$45.38	$10.00	$15.25	$0.00	$70.63
	06/01/2017	$46.38	$10.00	$15.25	$0.00	$71.63
	12/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$45.38	$10.00	$15.25	$0.00	$70.63
	06/01/2017	$46.38	$10.00	$15.25	$0.00	$71.63
	12/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$31.17	$10.00	$15.25	$0.00	$56.42
	06/01/2017	$31.86	$10.00	$15.25	$0.00	$57.11
	12/01/2017	$32.55	$10.00	$15.25	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY MIX CONCRETE DRIVERS after 4/30/10 (Drivers Hired After 4/30/2010)*TEAMSTERS LOCAL 25c*	05/01/2017	$28.18	$8.23	$9.72	$0.00	$46.13
	07/01/2017	$28.18	$8.48	$9.72	$0.00	$46.38
READY-MIX CONCRETE DRIVER *TEAMSTERS LOCAL 25c*	05/01/2017	$29.48	$8.23	$9.72	$0.00	$47.43
	07/01/2017	$29.48	$8.48	$9.72	$0.00	$47.68
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RESIDENTIAL WOOD FRAME (All Other Work) *CARPENTERS -ZONE 2 (Residential Wood)*	06/01/2016	$25.32	$9.80	$16.82	$0.00	$51.94
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)*	04/01/2017	$26.31	$7.07	$7.18	$0.00	$40.56
	10/01/2017	$26.93	$7.07	$7.18	$0.00	$41.18
	04/01/2018	$27.35	$7.07	$7.18	$0.00	$41.60
	10/01/2018	$27.77	$7.07	$7.18	$0.00	$42.02
	04/01/2019	$28.20	$7.07	$7.18	$0.00	$42.45
	10/01/2019	$28.63	$7.07	$7.18	$0.00	$42.88

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 - 04/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$15.79	$7.07	$0.00	$0.00	$22.86
2	60	$15.79	$7.07	$0.00	$0.00	$22.86
3	65	$17.10	$7.07	$7.18	$0.00	$31.35
4	70	$18.42	$7.07	$7.18	$0.00	$32.67
5	75	$19.73	$7.07	$7.18	$0.00	$33.98
6	80	$21.05	$7.07	$7.18	$0.00	$35.30
7	85	$22.36	$7.07	$7.18	$0.00	$36.61
8	90	$23.68	$7.07	$7.18	$0.00	$37.93

Effective Date - 10/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$16.16	$7.07	$0.00	$0.00	$23.23
2	60	$16.16	$7.07	$0.00	$0.00	$23.23
3	65	$17.50	$7.07	$7.18	$0.00	$31.75
4	70	$18.85	$7.07	$7.18	$0.00	$33.10
5	75	$20.20	$7.07	$7.18	$0.00	$34.45
6	80	$21.54	$7.07	$7.18	$0.00	$35.79
7	85	$22.89	$7.07	$7.18	$0.00	$37.14
8	90	$24.24	$7.07	$7.18	$0.00	$38.49

Notes:

Apprentice to Journeyworker Ratio:1:5

RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 1*	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	02/01/2017	$41.36	$11.10	$13.80	$0.00	$66.26
	08/01/2017	$42.46	$11.10	$13.80	$0.00	$67.36
	02/01/2018	$43.61	$11.10	$13.80	$0.00	$68.51
	08/01/2018	$44.71	$11.10	$13.80	$0.00	$69.61
	02/01/2019	$45.86	$11.10	$13.80	$0.00	$70.76

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ROOFER - Local 33*

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.68	$11.10	$3.44	$0.00	$35.22
2	60	$24.82	$11.10	$13.80	$0.00	$49.72
3	65	$26.88	$11.10	$13.80	$0.00	$51.78
4	75	$31.02	$11.10	$13.80	$0.00	$55.92
5	85	$35.16	$11.10	$13.80	$0.00	$60.06

Effective Date - 08/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.23	$11.10	$3.44	$0.00	$35.77
2	60	$25.48	$11.10	$13.80	$0.00	$50.38
3	65	$27.60	$11.10	$13.80	$0.00	$52.50
4	75	$31.85	$11.10	$13.80	$0.00	$56.75
5	85	$36.09	$11.10	$13.80	$0.00	$60.99

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.
(Hot Pitch Mechanics' receive $1.00 hr. above ROOFER)

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	02/01/2017	$41.61	$11.10	$13.80	$0.00	$66.51
	08/01/2017	$42.71	$11.10	$13.80	$0.00	$67.61
	02/01/2018	$43.86	$11.10	$13.80	$0.00	$68.76
	08/01/2018	$44.96	$11.10	$13.80	$0.00	$69.86
	02/01/2019	$46.11	$11.10	$13.80	$0.00	$71.01
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2017	$43.72	$11.45	$23.07	$2.35	$80.59
	08/01/2017	$44.82	$11.45	$23.07	$2.35	$81.69
	02/01/2018	$45.97	$11.45	$23.07	$2.35	$82.84

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SHEET METAL WORKER - Local 17-A*

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.49	$11.45	$5.24	$0.00	$34.18
2	40	$17.49	$11.45	$5.24	$0.00	$34.18
3	45	$19.67	$11.45	$10.31	$1.24	$42.67
4	45	$19.67	$11.45	$10.31	$1.24	$42.67
5	50	$21.86	$11.45	$11.21	$1.34	$45.86
6	50	$21.86	$11.45	$11.46	$1.34	$46.11
7	60	$26.23	$11.45	$13.02	$1.52	$52.22
8	65	$28.42	$11.45	$13.93	$1.61	$55.41
9	75	$32.79	$11.45	$15.74	$1.80	$61.78
10	85	$37.16	$11.45	$17.05	$1.97	$67.63

Effective Date - 08/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.93	$11.45	$5.24	$0.00	$34.62
2	40	$17.93	$11.45	$5.24	$0.00	$34.62
3	45	$20.17	$11.45	$10.31	$1.26	$43.19
4	45	$20.17	$11.45	$10.31	$1.26	$43.19
5	50	$22.41	$11.45	$11.21	$1.35	$46.42
6	50	$22.41	$11.45	$11.46	$1.36	$46.68
7	60	$26.89	$11.45	$13.02	$1.54	$52.90
8	65	$29.13	$11.45	$13.93	$1.64	$56.15
9	75	$33.62	$11.45	$15.74	$1.82	$62.63
10	85	$38.10	$11.45	$17.05	$2.00	$68.60

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 A*	12/01/2016	$33.54	$10.91	$10.89	$0.00	$55.34
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2016	$33.83	$10.91	$10.89	$0.00	$55.63
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	03/01/2017	$56.08	$8.77	$17.20	$0.00	$82.05

Apprentice - *SPRINKLER FITTER - Local 550 (Section A) Zone 1*

Effective Date - 03/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.63	$8.52	$8.70	$0.00	$36.85
2	40	$22.43	$8.52	$8.70	$0.00	$39.65
3	45	$25.24	$8.52	$8.70	$0.00	$42.46
4	50	$28.04	$8.52	$8.70	$0.00	$45.26
5	55	$30.84	$8.52	$8.70	$0.00	$48.06
6	60	$33.65	$8.52	$10.20	$0.00	$52.37
7	65	$36.45	$8.52	$10.20	$0.00	$55.17
8	70	$39.26	$8.52	$10.20	$0.00	$57.98
9	75	$42.06	$8.52	$10.20	$0.00	$60.78
10	80	$44.86	$8.52	$10.20	$0.00	$63.58

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*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 103*	03/01/2017	$36.25	$13.00	$15.60	$0.00	$64.85
	09/01/2017	$36.96	$13.00	$15.62	$0.00	$65.58
	03/01/2018	$37.86	$13.00	$15.65	$0.00	$66.51
	09/01/2018	$38.75	$13.00	$15.67	$0.00	$67.42
	03/01/2019	$39.65	$13.00	$15.70	$0.00	$68.35

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 103*

Effective Date - 03/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$14.50	$13.00	$0.44	$0.00	$27.94
2	40	$14.50	$13.00	$0.44	$0.00	$27.94
3	45	$16.31	$13.00	$12.54	$0.00	$41.85
4	45	$16.31	$13.00	$12.54	$0.00	$41.85
5	50	$18.13	$13.00	$12.81	$0.00	$43.94
6	55	$19.94	$13.00	$13.09	$0.00	$46.03
7	60	$21.75	$13.00	$13.37	$0.00	$48.12
8	65	$23.56	$13.00	$13.65	$0.00	$50.21
9	70	$25.38	$13.00	$13.93	$0.00	$52.31
10	75	$27.19	$13.00	$14.21	$0.00	$54.40

Effective Date - 09/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$14.78	$13.00	$0.44	$0.00	$28.22
2	40	$14.78	$13.00	$0.44	$0.00	$28.22
3	45	$16.63	$13.00	$12.55	$0.00	$42.18
4	45	$16.63	$13.00	$12.55	$0.00	$42.18
5	50	$18.48	$13.00	$12.82	$0.00	$44.30
6	55	$20.33	$13.00	$13.10	$0.00	$46.43
7	60	$22.18	$13.00	$13.39	$0.00	$48.57
8	65	$24.02	$13.00	$13.66	$0.00	$50.68
9	70	$25.87	$13.00	$13.95	$0.00	$52.82
10	75	$27.72	$13.00	$14.22	$0.00	$54.94

Notes:

Apprentice to Journeyworker Ratio:1:1

TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2017	$49.70	$10.75	$19.22	$0.00	$79.67

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.85	$10.75	$19.22	$0.00	$54.82
2	60	$29.82	$10.75	$19.22	$0.00	$59.79
3	70	$34.79	$10.75	$19.22	$0.00	$64.76
4	80	$39.76	$10.75	$19.22	$0.00	$69.73
5	90	$44.73	$10.75	$19.22	$0.00	$74.70

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE* For apprentice rates see "Apprentice- LABORER"	12/01/2016	$37.70	$7.60	$14.35	$0.00	$59.65
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE* For apprentice rates see "Apprentice- LABORER"	12/01/2016	$36.42	$7.60	$14.35	$0.00	$58.37
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE* For apprentice rates see "Apprentice- LABORER"	12/01/2016	$36.30	$7.60	$14.35	$0.00	$58.25
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2016	$44.94	$10.00	$15.25	$0.00	$70.19
	06/01/2017	$45.93	$10.00	$15.25	$0.00	$71.18
	12/01/2017	$46.92	$10.00	$15.25	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2016	$34.12	$10.91	$10.89	$0.00	$55.92
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)* For apprentice rates see "Apprentice- LABORER"	12/01/2016	$48.58	$7.60	$14.75	$0.00	$70.93
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)* For apprentice rates see "Apprentice- LABORER"	12/01/2016	$50.58	$7.60	$14.75	$0.00	$72.93
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)* For apprentice rates see "Apprentice- LABORER"	12/01/2016	$40.65	$7.60	$14.75	$0.00	$63.00
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)* For apprentice rates see "Apprentice- LABORER"	12/01/2016	$42.65	$7.60	$14.75	$0.00	$65.00
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	12/01/2016	$33.54	$10.91	$10.89	$0.00	$55.34

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
WAGON DRILL OPERATOR	12/01/2016	$36.60	$7.60	$14.15	$0.00	$58.35
LABORERS - ZONE 1	06/01/2017	$37.60	$7.60	$14.15	$0.00	$59.35
	12/01/2017	$38.45	$7.60	$14.15	$0.00	$60.20
	06/01/2018	$39.40	$7.60	$14.15	$0.00	$61.15
	12/01/2018	$40.35	$7.60	$14.15	$0.00	$62.10
	06/01/2019	$41.35	$7.60	$14.15	$0.00	$63.10
	12/01/2019	$42.35	$7.60	$14.15	$0.00	$64.10
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR	12/01/2016	$45.38	$10.00	$15.25	$0.00	$70.63
OPERATING ENGINEERS LOCAL 4	06/01/2017	$46.38	$10.00	$15.25	$0.00	$71.63
	12/01/2017	$47.38	$10.00	$15.25	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER	03/01/2017	$52.69	$11.32	$15.46	$0.00	$79.47
PLUMBERS & GASFITTERS LOCAL 12						
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone)	08/28/2016	$26.61	$7.50	$1.80	$0.00	$35.91
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$27.14	$7.75	$1.81	$0.00	$36.70
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables)	08/28/2016	$37.70	$7.50	$8.87	$0.00	$54.07
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$38.45	$7.75	$9.53	$0.00	$55.73
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL	08/28/2016	$31.05	$7.50	$8.89	$0.00	$47.44
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$31.66	$7.75	$9.44	$0.00	$48.85
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs)	08/28/2016	$24.39	$7.50	$1.73	$0.00	$33.62
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL)	08/28/2016	$37.70	$7.50	$12.95	$0.00	$58.15
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$38.45	$7.75	$13.61	$0.00	$59.81
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL)	08/28/2016	$33.26	$7.50	$9.63	$0.00	$50.39
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$33.92	$7.75	$10.21	$0.00	$51.88
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN	08/28/2016	$24.39	$7.50	$1.73	$0.00	$33.62
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.)	08/28/2016	$19.96	$7.50	$1.60	$0.00	$29.06
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$20.35	$7.75	$1.61	$0.00	$29.71
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN	08/28/2016	$44.35	$7.50	$15.83	$0.00	$67.68
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	09/03/2017	$45.23	$7.75	$16.61	$0.00	$69.59

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 08/28/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.61	$7.50	$3.30	$0.00	$37.41
2	65	$28.83	$7.50	$3.36	$0.00	$39.69
3	70	$31.05	$7.50	$3.43	$0.00	$41.98
4	75	$33.26	$7.50	$5.00	$0.00	$45.76
5	80	$35.48	$7.50	$5.06	$0.00	$48.04
6	85	$37.70	$7.50	$5.13	$0.00	$50.33
7	90	$39.92	$7.50	$7.20	$0.00	$54.62

Effective Date - 09/03/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$27.14	$7.75	$3.31	$0.00	$38.20
2	65	$29.40	$7.75	$3.38	$0.00	$40.53
3	70	$31.66	$7.75	$3.45	$0.00	$42.86
4	75	$33.92	$7.75	$5.02	$0.00	$46.69
5	80	$36.18	$7.75	$5.09	$0.00	$49.02
6	85	$38.45	$7.75	$5.15	$0.00	$51.35
7	90	$40.71	$7.75	$7.22	$0.00	$55.68

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$28.98	$4.25	$3.12	$0.00	$36.35
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/31/2016	$18.51	$3.55	$0.00	$0.00	$22.06

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*	01/31/2016	$16.32	$3.55	$0.00	$0.00	$19.87

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.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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.)
Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

** 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.

BY-LAWS OF THE TOWN OF ARLINGTON
TITLE I
ARTICLE 16

CONSTRUCTION PROJECTS

Section 1. Women Work Force Participation
Any Town board or official in charge of a construction or reconstruction project is required to include in the contract documents the following:

A. Contractor shall maintain as a goal on this project a not less than five percent ratio of women work force to total project hours in both the general contract and each individual filed sub-bid contract, if applicable. The preceding sentence shall be included in all construction contracts whether entered into by the Town pursuant to the provisions of M.G.L. c. 149 or M.G. L. c 30, §39M et. seq. provided however, that if entered into under Chapter 30 same shall not be deemed to apply where the projected bid price as determined by the Director of Public Works is not likely to exceed $200,000.

B. A Labor Scheduling Table which will be used as a tool for achieving a range of women work force participation for the entire project in both the general contract and each individual filed sub-bid contract.

Section 2. Equal Opportunity Goal Compliance
Any Town board or official in charge of a construction or reconstruction project is required to include in the contract documents the following:

A. Before starting work, the contractors (includes the general contractor, for itself and its subcontractors, as well as all filed sub-bid contractors, if applicable) will submit plans for achievement of the equal opportunity goals of the contract. All contractors will be required to make a good faith effort to achieve these goals. The plan will indicate if the contractors expect to achieve the requirements during the first quarter. If there are reasons why the contractors do not expect to achieve the requirements during the first quarter year of the contract construction phase, then the contractors shall provide a plan calculated to address, to the extent reasonably possibly, these obstacles to a good faith effort to achieve such goals.

B. Not more than ten days following the end of each work quarter, the contractors will report on the achievement of the goals, detailing the good faith efforts that have been made and will continue to be made and any other appropriate efforts not yet undertaken.

C. All reports will be signed by an officer or principal of the company who has the authority to contractually obligate the company.

Section 3. Recruitment and Training
Any board, officer, committee, or other agency of the Town, which acts on behalf of the Town in making or supervising any contract, in an amount exceeding the sum of $100,000 for the purchase of goods or services or for the construction, renovation, or repair of buildings or other improvement of real estate, may make arrangements with contractors and other interested agencies for special programs of recruitment and training in connection with the work to be performed on such contract, with the objective of promoting equal employment opportunity for members of minority groups protected by the fair employment laws of the Commonwealth and the United States. Any board, officer, committee or other Town agency may expend Town funds in carrying them out provided that appropriations specifically designed for such purposes have been voted by the Town Meeting.

TOWN OF ARLINGTON
EQUAL OPPORTUNITY ADVISORY COMMITTEE
730 MASSACHUSETTS AVENUE, ARLINGTON, MA 02476
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CONTRACTOR CERTIFICATION

During the performance of the Contract, the Contractor and all subcontractors (hereafter collectively referred to as "the Contractor") for a town construction contract or town assisted construction contract, for him/herself, his/her assignees and successors in interest, agree to comply with all applicable equal employment opportunity, non-discrimination and affirmative action requirements, including but not limited to the following:

The Contractor shall comply with the provisions of Town of Arlington Bylaws, Anti-Discrimination policies and Chapter 151B of the Massachusetts General Laws, as amended, and all other applicable anti-discrimination and equal opportunity laws, all of which are herein incorporated by reference and made a part of this contract.

In connection with the performance of work under this contract, the Contractor shall undertake, in good faith, affirmative action measures to eliminate any discriminatory barrier in the terms and conditions of employment on the grounds of race, color, religious creed, national origin, sex, gender identity, sexual orientation, age, genetic information, ancestry, children, marital status, veteran status or membership in the armed service, the receiving of public assistance, and handicap. Such affirmative action measures shall entail a list of positive and aggressive measures which shall include but not be limited to, advertising employment opportunities in minority and other community news media; notifying minority women and other community-based organizations of employment opportunities; maintaining a file of names and addresses of each worker referred to the Contractor and what action was taken concerning such worker; and notifying this Committee in writing when a union with whom the Contractor has a collective bargaining agreement has failed to refer a minority or woman worker.

The Contractor shall submit to the Equal Opportunity Advisory Committee, through the Purchasing Director Domenic Lanzillotti, the following Contractor's Certification with all attachments. The Contractor's Certification will be reviewed by the Committee and will inform the Contractor of any deficiencies to be corrected.

CONTRACTOR CERTIFICATION

_____ certifies that they:

(Contractor Name)

1. Will not discriminate in their employment practices.

2. Intend to use, if General Contractor, the following listed construction trades in the work under the contract:

   _____

   _____

   _____

3. If Trade Subcontractor, will provide the following work under the contract:

   _____

   _____

   _____

4. Will make good faith efforts to comply with the minority employee and women employee workforce participation ratio goals of the Town of Arlington and the Commonwealth of Massachusetts and specific affirmative steps contained herein; and to provide evidence of its good faith efforts. Attached hereto, please find:

A. Employment Opportunities advertised in:

   _____

   _____

   _____

B. Notification to Minority/Women/Community based Organizations such as:

   _____

   _____

   _____

C. List of workers referred to Contractor and note on what action was taken:

_____

_____

_____

D. Written notification that Union/Local No. _____ failed to refer a Minority or Female worker during the week of: _____

_____

Signature of Officer Date

_____

Printed Name of Officer and Title

SECTION 01 23 00: ALTERNATES

1.0 INSTRUCTIONS AND PROVISIONS

1.1 Each Bidder shall be held fully responsible for examining the scope of the alternates generally defined herein and for recognizing any modifications to the Work caused by any alternate whether or not the particular trade Section is mentioned therein.

1.2 All sections of the Work that are affected by the alternates will be considered Work to be performed by the **General Contractor**.

1.3 General Bidders shall enter a single amount in the appropriate space provided in the Form for Bid, which total amount shall consist of the amount for all work to be performed by the **General Contractor**.

1.4 The Work of the various Subcontractors and trades to be performed under alternates shall be in strict accordance with the requirements of the particular trade Section of the Specifications.

2.0 ALTERNATE NO. 1 – SIDE DRIVEWAY SCOPE

2.1 Scope: Contractor shall perform all work necessary to install bituminous concrete, concrete accessible ramp and walkway, reset granite curbing, patching and restriping a portion of the rear parking lot, as shown on the Contract Drawings and as specified in the Project Manual**.** All materials, any base materials, delivery costs, labor, or equipment necessary to install these components shall be included in the cost.

2.2 ALTERNATE NO. 2 – CONCRETE PAVING IN TURNAROUND

2.3 Scope: Contractor shall perform all work necessary to install reinforced concrete paving as shown on the Contractor Drawings and as specified in Section 32 13 13 – REINFORCED CONCRETE PAVING**.** All materials, any base materials, delivery costs, labor, or equipment necessary to install these components shall be included in the cost.

END OF SECTION 01 23 00
ALTERNATES

SECTION 02 41 00: SITE PREPARATION AND DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to prepare the site, complete, as indicated on the Contract Documents, as specified, and as follows:

1. Protection of existing structures and utilities
2. Protection of Public Works Department sidewalks
3. Salvage, stockpile on-site, and reuse of materials
4. Salvage materials and stockpile off-site
5. Removal and disposal of materials
6. Erosion control for all area drains and catch basins
7. Protection and adjustment of existing irrigation system

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 01 Section – SPECIAL PROJECT PROCEDURES
2. Division 31 Section – EARTH MOVING
3. Division 31 Section – SITE CLEARING
4. Division 32 Section – TREE PRUNING AND REMOVAL
5. Division 32 Section – SITE MASONRY
6. Division 32 Section – BRICK UNIT PAVING

1.04 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Massachusetts Department of Transportation (MassDOT):
Specifications Standard Specifications for Highways and Bridges

1.05 PROTECTION

A. Do not interfere with use of adjacent buildings or facilities. Maintain free and safe passage to and from adjacent buildings and facilities or both and between them and the public way.

B. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the discontinuance or interruption of all public and private utilities or services.

C. Cease operations and notify Owner immediately if safety of adjacent structures, workers, or the general public appears to be endangered. Take precautions to properly support structures and protect workers and general public. Do not resume operations until safety is restored.

D. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner. Furnish, erect and maintain fences, planking, bracing, shoring, sheathing, lights barricades, warning signs, and guards as necessary for the protection of streets, sidewalks, and adjoining property.

E. Trees that are damaged during construction shall be removed by the Contractor at their expense if instructed to do so by the Landscape Architect, and the Contractor shall pay the Boston Parks and Recreation Department for each tree judged by a Massachusetts Certified Arborist to be significantly damaged or injured, whether or not it is removed.

1.06 GENERAL REQUIREMENTS

A. The Contractor shall secure a DIG SAFE permit number for the project to certify notification of gas, electrical and telephone utilities. All other affected utilities shall be contacted by the Contractor who shall secure notification receipts in accordance with requirements of Massachusetts law. The phone number is 811. Contractors shall notify "Dig Safe" of contemplated excavation, demolition or explosive work in public or private ways, and utility company right-of-way or easement. This notification shall be made at least 72 hours prior to the work, but not more than sixty days before the contemplated work. Such notice shall set forth the name of the street or the route number of said way and an accurate description of the location and nature of the proposed work. The Landscape Architect requires that the notification be sent to "Dig Safe" by certified mail, with copies to the Owner. The Architect requires a copy of the signed receipt of the delivery. "Dig-Safe" is required to respond to the notice within 72 hours from the time said notice is received by designating at the locus the location of pipes, mains, wires and conduits. Contractor shall not commence work until "Dig-Safe" has responded as noted above. The work shall then be performed in such a manner, and with reasonable precaution taken to avoid damage to utilities under the surface in said areas of the work.

B. The Contractor shall, prior to any removal of rubbish or debris from the site, furnish written evidence satisfactory to the Landscape Architect that he has an approved dumping location for debris and/or spoil form his removals and excavation activities.

C. On-site cleaning of materials for the purpose of salvage on the site shall not be permitted.

D. The Contractor shall secure all necessary permits from the Town of Arlington before starting this project.

E. The Town of Arlington shall have the right of first refusal on all removed materials, at the direction of the Landscape Architect. All materials refused by the City shall become the property of the Contractor.

F. For all earthwork, excavation, and removals within the driplines of protected trees (not limited to areas within designated tree protection fencing), the Landscape Architect must be present on the site or have specifically waived that obligation. Provide 48 hours' notice prior to commencement of all such work.

PART 2 – PRODUCTS

2.01 TEMPORARY CONSTRUCTION FENCING

A. Temporary construction fencing shall be provided and paid for under as specified under Division 01 Section – SPECIAL PROJECT PROCEDURES.

B. Site protection fencing shall include installation and maintenance. Installation shall be suitable to withstand the duration of the project. The Contractor shall be responsible for maintaining the site protection fence in good order and if necessary, must make any adjustments immediately to ensure site safety. The Contractor shall be responsible for maintaining a clean work site including debris, trash and vegetative material removal along the temporary fence line throughout the duration of the project.

1. Portable Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch O.D. line posts and 2-7/8-inch O.D. corner and pull posts, with 1-5/8-inch O.D. top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.

2.02 EROSION CONTROL

A. Inlet protection for catch basin protection shall be Silt Sack or an approved equal.

B. Straw wattle shall be used as shown on Contract Documents. Wattle shall consist of the following:

Wattle Type	12” Wattle
Diameter	12” diameter
Length	20 feet
Density	3 pounds/ linear foot
Filling	Wheat Straw
Netting	Polyethelene

1. Straw wattle and all temporary erosion and sediment control methods must be removed prior to Project Closeout.

PART 3 – EXECUTION

3.01 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Existing structures, monuments, vegetation, fencing, and utilities shall be suitably protected from damage, including but not limited to existing pavements and curbs, site walls, lighting, fencing, concrete vault, manholes, and utility lines.

1. Sidewalks (brick and concrete) scheduled to remain shall be protected with plywood.

B. Provide and install erosion and sedimentation control at all existing catch basins, manholes and all other utility structures as identified on the drawings. Protect public right-of-way from the entry of erosion and construction debris.

C. The lawn area on the Maple Street side of the building has working irrigation. Contractor is responsible for modifying and adjusting all pipes and heads impacted by construction.

3.02 SALVAGE, STOCKPILE ON SITE, AND REUSE MATERIALS

A. Materials indicated on the Contract Documents or designated by the Landscape Architect in the field to be salvaged shall be carefully removed, protected from damage, and put in temporary storage as follows:

1. Salvaged material for re-use on site shall be stockpiled on-site in an area designated by the Owner of Landscape Architect:
   a. Street light fixtures, poles and bases
   b. Granite curbing
   c. Site benches – to be refurbished
   d. Bike rack to be reinstalled
   e. Brick pavers on Maple Street sidewalk

3.03 REMOVAL AND DISPOSAL OF MATERIALS

A. Materials indicated on the Contract Documents or designated by the Landscape Architect in the field to be removed shall be dismantled, removed, and legally disposed of off-site as indicated on the Contract Documents and as specified, performed and paid for in this DIVISION 02 SECTION, SITE PREPARATION & DEMOLITION. Removals include but are not limited to the following:

1. Brick pavers on side driveway and turnaround
2. Concrete footings for site lighting
3. Curbing not in condition to be reused (to be determined by Landscape Architect) and with radii that does not conform to layout
4. Concrete pads and footings as noted on Contract Drawings

B. Material resulting from the site preparation work and not scheduled to be salvaged and which is unsuitable for reuse on the project, shall become the property of the Contractor and shall be legally disposed of off-site.

C. Debris, rubbish, and other material shall be disposed of promptly and shall not be left until final cleanup of site.

D. Existing site structures indicated on the Contract Documents to be removed, shall be completely dismantled and removed from the site.

E. Sawcut pavements at the limits shown on the drawings prior to demolition.

F. Removal of pavements shall include subbase material unless specifically noted on the Contract Drawings. Contractor shall be responsible for removing materials to stable subbase.

3.04 EROSION CONTROL

A. The Contractor shall comply with Town of Arlington regulations and shall plan and execute all operations, particularly those associated with excavation and backfilling, in such a manner as to prohibit excavated and exposed fill or other foreign material to be washed or otherwise carried into streets, drains, or waterways. The water quality of storm drains shall not be degraded due to construction operations.

B. In the event that sedimentation or siltation prevention measures used by the Contractor provide to be inadequate the Contractor shall be required to adjust their operations to the extent necessary to prevent such sedimentation or siltation from occurring. Any damage or degradation caused by inadequate controls must be restored by the Contractor at no additional cost to the Owner.

C. The Contractor shall keep all drains clear of mud, silt, debris, or other objectionable materials resulting from construction operations.

D. The Contractor shall minimize the amount of bare earth exposed at any one time during construction, and minimize the length of time bare earth is exposed.

E. Baled hay and filter materials shall be placed to form temporary water stops, dams, diversions, dikes, berms, and for other uses connected with water pollution control. As directed by the Landscape Architect bales may be disposed by the Contractor as best suits field conditions and requirements.

F. Sediment-laden water that is being pumped from trenches or excavations shall not be pumped directly into storm drains or water courses. Sedimentation tanks or other means acceptable to the Landscape Architect shall be used for this purpose.

G. All sedimentation and erosion control measures shall be in accordance with all permits, regulatory requirements, plans and specifications.

H. Inlet protection shall be installed prior to the start of construction activities.

I. Additional erosion control in the form of hay bales, filter tube, silt fence, etc. shall be employed by the Contractor as required to prevent erosion of topsoil or other materials.

J. Erosion control shall be reviewed regularly to keep in good condition especially following any rain events.

K. All erosion and sediment controls shall be removed from the project as designate by the Landscape Architect but prior to Project Closeout.

3.05 PROTECTION OF EXISTING TREES AND VEGETATION

A. The Contractor shall make every effort not to damage existing plant materials to remain. The Contractor is required to install protection as necessary to assure undamaged plant material and adjacent conditions.

1. See additional information on the protection of maple trees located in circular driveway designated to remain and be protected, in Division 31 Section – SITE CLEARING of this Specification.

1. See Division 32 Section – TREE PRUNING & REMOVAL of this specification.

B. Vehicles shall not be parked within the dripline or where damage may result to trees to be saved. Construction materials shall not be stored beneath trees to be saved.

C. Repair/replace vegetation that is damaged at no additional cost to Owner. Employ certified arborist to repair damaged trees.

3.06 REMOVAL OF ROCK/BURIED CONCRETE EXCAVATION

A. Contractor shall carry as part of the contract excavation and removal of up to five cubic yards of buried concrete or rock. If the excavation and removal is not required as part of the project, the cost shall be credited accordingly.

END OF SECTION 02 41 00
SITE PREPARATION & DEMOLITION

SECTION 03 30 00: CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all equipment and materials and do all work necessary to complete the cast-in-place concrete work, as indicated in the Contract Documents and as specified.

B. Provide all equipment and materials, and do all work necessary to complete the cast-in-place concrete work which includes, but is not necessarily limited to the following:

1. Cast-in-place concrete as used in the following:
   a. Add alternate #1: Concrete accessible ramp and walkway
   b. Add alternate #2: Reinforced concrete paving
   c. Concrete foundations and footings
   d. Concrete pads for site furnishings
   e. Make provisions in forms for proper location and installation of pipe sleeves, keys, chases, electrical boxes, bolts, anchors, inserts, and similar items, as required by other trades. Notify appropriate trades when items noted are ready for installation.
   f. Unless specifically excluded, furnishing and installation of any other items of cast-in-place concrete work indicated on Contract Documents, specified, or obviously needed to make work of this Section complete.
2. Forms
3. Forms ties
4. Reinforcing steel and mesh
5. Grout for setting anchor pins
6. Cutting and patching
7. Stainless steel anchor pins
8. Control joints
9. Expansion joints

1.03 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – CONCRETE PAVING

1.04 REFERENCES

A. Except as noted, work shall conform to the latest edition of the following codes specifications and standards:

1. AASHTO: American Association of State Highway and Transportation Officials
   M153
   M182
   M194

2. ASTM: American Society for Testing and Materials
   A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

A108	Standard Specification for Steel Bars, Carbon, cold-Finished, Standard Quality
A185	Standard Specification for Steel Welded Wire Fabric, Plain, For Concrete Reinforcement
A276	Standard Specification for Stainless Steel Bars and Shapes
A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
A497	Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
A510	Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
A615/A615M	Standard Specification for Deformed and Plain Billet-Steel bars for Concrete Reinforcement
A775/A775M	Standard Specification for Epoxy-Coated Reinforcing Steel Bars
A884/A884M	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement
C31/C31M	Standard Practice for Making and Curing Concrete Test Specimens in the Field
C33	Standard Specification for Concrete Aggregates
C39/C39M	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C40	Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
C42/C42M	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C94/C94M	Standard Specification for Ready-Mixed Concrete
C109/C109M	Standard Test method for Compressive Strength of Hydraulic Cement Mortars
C143/C143M	Standard Test Method for Slump of Hydraulic Cement Concrete
C150	Standard Specification for Portland Cement
C171	Standard Specification for Sheet Materials for Curing Concrete
C172	Standard Practice for Sampling Freshly Mixed Concrete
C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260	Standard Specification for Air-Entraining Admixtures for Concrete
C330	Standard Specification for Lightweight Aggregates for Structural Concrete
C348	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
C494/C494M	Standard Specification for Chemical Admixtures for Concrete
C496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
C567	Standard Test Method for Density Structural Lightweight Concrete
C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C827	Standard Test Method for Change in height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
C1064/C1064M	Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
E154	Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover
E488	Standard Test Method for Strength of Anchors in Concrete and masonry Elements

3. ACI: American Concrete Institute:

ACI 301	Specifications for Structural Concrete for Buildings
ACI 304	Handling Concrete
ACI 305R	Hot Weather Concreting
ACI 306.1	Standard Specifications for Cold Weather Concreting
ACI 315	Manual of Standard Practice for Detailing Reinforced Concrete Structures
ACI 318/318R	Building Code Requirements for Reinforced Concrete
ACI 347R	Guide to Formwork for Concrete
	SP-66

4. CRSI: Concrete Reinforcing Steel Institute:
   Reinforced Concrete - A Manual of Standard Practice, latest edition
   Recommended Practice for Placing Reinforcing Bars, latest edition

5. FHWA: Federal Highway Administration
   Program Report No. FHWAJRD86/193

6. Commonwealth of Massachusetts Department of Transportation (MassDOT):
   Specifications Standard Specifications for Highways and Bridges

1.05 SUBMITTALS

A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, curing compounds, rebar mechanical splicers, rebar epoxy coating and epoxy coat patching material, WWF epoxy coating and epoxy coat patching material, epoxy adhesive for anchoring rebar, expansion bolts, and other items if requested by the Landscape Architect. Contractor shall review all Contract Documents for all items that are required to be embedded in concrete, and shall make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.

B. Shop drawings for reinforcement detailing, fabricating, bending, and placing of all concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Show reinforcing in elevation for beams and walls, show reinforcing in plan for slabs and toppings, show all reinforcing splices and labs, show dowels with concrete element to be cast first, and show details where interference of reinforcing may occur.

C. Name and address of Testing Laboratory for approval by Landscape Architect.

D. Submit two copies of laboratory test reports for concrete materials and mix designs tests as specified.

E. Corrective Work: submit drawings showing details of any proposed corrective work, prior to performing corrective work.

F. Concrete Curing and Protection: Submit to Landscape Architect detailed methods proposed for curing and protecting concrete in normal, cold and hot conditions.

G. Mill Test Certification: Submit to Landscape Architect, prior to delivery of reinforcing steel or concrete to the job site, certified mill test reports of reinforcing steel and cement, (including names and locations of mills and shops, and analyses of chemical and physical properties), properly correlated to concrete to be used in this Project. This submittal is for information and file record.

H. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

I. The Contractor shall be responsible for furnishing and installing materials called for in Contract Documents, even though these materials may have been omitted from approved shop drawings.

1.06 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Contractor shall select and the Owner shall approve a qualified independent testing agency to perform on-site observation and testing during the construction operations. Independent testing agency shall be paid directly by the Contractor and reimbursed by the Owner upon submission of receipts for testing and observation services. Owner will not reimburse Contractor for testing services or field observation when test results indicate that materials do not meet the requirements of this Section.

1. Concrete shall be tested and reported for each batch.

B. Unless otherwise specified, work and materials for construction of the reinforced Portland cement concrete paving shall conform to ACI 316R, and applicable portions of the following:

1. MassDOT Standard Specifications Section 476 Cement Concrete Pavement

C. Sampling and testing for quality control during concrete placement shall include the following, as directed by the Landscape Architect.

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
   a. Slump: ASTM C143; one test at point of discharge for each concrete truck load and one test for each set of compressive strength test specimens.
   b. Air Content: ASTM Cl73. volumetric method for light weight or normal weight concrete: ASTM C231, pressure method for normal weight concrete; one for each set of compressive strength specimens.
   c. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 degrees Fahrenheit and below, when 80 degrees Fahrenheit and above, and one test for each set of compressive-strength specimens.
   d. Compression Test Specimen: ASTM C31: one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
   e. Compressive Strength Tests ASTM C39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cubic yards more than the first 25 cubic yards of each concrete class placed in any one day, one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than five are used.
3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete
4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 pounds per square inch (3.5 MPa).

C. Testing: All personnel and laboratories testing concrete shall be licensed by the Commonwealth of Massachusetts.

D. Forms and Reinforcing: The Contractor shall verify that forms and reinforcing steel have been installed in accordance with the specified requirements.

E. Test results shall be reported in writing to the Landscape Architect, Structural Engineer, and ready-mix producer within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

G. Additional Tests: The testing agency shall make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure,

as directed by the Landscape Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed

H. In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Owner may require test cores of the hardened structure to be taken by the Testing Laboratory in accordance with ASTM C42. If such test indicates that the core specimen is below the required strength, the concrete in question shall be removed and replaced without cost to the Owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the Owner at no additional cost to the Owner. The cost of coring will be deducted from the contract amount. Where core cylinders have been taken by the Testing Laboratory and the concrete proves to be satisfactory, core holes shall be filled in a manner satisfactory to the Owner at no additional cost to the Owner.

I. The Contractor shall coordinate the date and location of tests with the Owner before any concrete work is started.

J. The testing laboratory's presence does not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the testing laboratory, any inspection wherever conducted, nor any observations and testing performed by the testing laboratory shall excuse the Contractor from defects discovered in his work, nor relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of material or workmanship prevent later rejection of same by the Landscape Architect if defects are discovered.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Reinforcing steel shall be transported to the site, stored, and covered in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete. Store reinforcement steel on wood skids to protect it from weather, oil, earth, and damage from trucking or other construction operations. A sufficient supply of approved reinforcing steel shall be stored on the site at all times to ensure that there will be no delay of the work. Reinforcement shall be free from loose mill scale, rust, form oil, concrete splatter and other extraneous coating at the time it is embedded in the concrete.

B. Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any materials which have deteriorated, or which have been damaged, shall not be used for concrete.

C. Identification of steel shall be maintained after bundles are broken.

1.08 EXAMINATION OF SITE AND DOCUMENTS

A. The Contractor shall carefully examine the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions as indicated in the Contract Documents, or obvious from observations from the site.

B. Examine Contract Documents, surveys, measurements and dimensions during the bid period. Any discrepancies, errors or omissions shall be brought to the attention of the Landscape Architect prior to submission of a bid.

1.09 USE OF SITE

A. The Contractor shall conduct his operations so as to interfere as little as possible with the use ordinarily made of roads, driveways, sidewalks or other facilities near enough to the work to be affected thereby.

1.10 PERMITS AND CODES

A. Comply with the local, state and federal rules, regulations, laws and ordinances, and of all other authorities having jurisdiction. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.

1.11 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements of the Contract and the following:

1. At least 30 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule for procedures for materials inspection, testing and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:
   a. Contractor's superintendent
   b. Agency responsible for concrete design mixes
   c. Agency responsible for field quality control
   d. Ready-mix concrete producer
   e. Concrete subcontractor
   f. Primary admixture manufacturer

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement shall be ASTM C150, Type I or II, free from water-soluble salts or alkalies which will cause efflorescence on exposed surfaces. Only one brand of cement shall be used on the project.

B. Fly ash shall conform to the requirements of ASTM C618, Type C. Fly ash shall not exceed 25 percent of cement content by weight.

C. Aggregates:

1. Fine Aggregates for Concrete: Shall be natural sand consisting of clean, hard, durable, uncoated particles, conforming to ASTM C33. Organic content shall be determined according to ASTM C33. Organic content shall be determined according to ASTM C40, and supernatant liquid above test sample shall show color no darker than reference standard color solution prepared at the same time. Allow no frozen or partially frozen aggregate in the mix.
2. Coarse Aggregate for Concrete: Use crushed stone or gravel from approved source conforming to ASTM C33. Maximum size aggregate to be 0.75 inch.

D. Lightweight Fine and Coarse Aggregates: Rotary kiln expanded shale and conforming to ASTM C330 and as specified in this Section. Aggregate sizes shall include fine aggregate designated as "sand size", and coarse aggregate designated as graded 0.75 inch size.

E. Admixtures:

1. Calcium chloride, triocynanates, and admixtures containing more than 0.05 percent chloride ions are not permitted.
2. Air-entraining Agent shall conform to ASTM C260 for Air-entraining Admixtures for Concrete. Air-entraining agent must be by the same manufacturer as water-reducing agent.
3. Water Reducing Agent shall conform to ASTM C494 Type A for Chemical Admixtures for Concrete. Water-reducing agent must be by the same manufacturer as air-entraining agent.
4. High-range water reducing admixture (Super Plasticizer) shall conform to ASTM C494, type For Type G.
5. Water-reducing set retarders shall conform to ASTM C494 Type D and may be used when ambient temperatures exceed 80 degrees Fahrenheit. Do not use without specific approval of the Landscape Architect.

6. Accelerator admixture shall be a non-chloride and non-corrosive accelerator conforming to ASTM C494 Type C and may be used when temperatures are below 50 degrees Fahrenheit. Do not use without specific approval of the Landscape Architect.
7. Corrosion inhibitor admixture shall be a calcium nitrite based inhibitor complying with AASHTO M194 type C, such as W.R. Grace DCI Corrosion Inhibitor" or approved equal, applied at the rate of 4.0 gallons per cubic yards of concrete

F. Water from approved source shall be potable, clean, and free of oils, salt, alkali, organic matter and other deleterious materials detrimental to concrete.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars shall be new, deformed billet steel bars, conforming to ASTM A615, Grade 60 deformed.

B. Epoxy-coated reinforcing bars shall conform to ASTM A775, except that minimum coating thickness shall be 10 mils. Epoxy coat reinforcing bar steel and welded wire fabric so designated on the Contract Documents after fabrication in compliance with ASTM A775. Inspect epoxy coated reinforcing for compliance with ASTM A775 and tag the reinforcing with the name of the epoxy facility, the ASTM number and coating thickness. A notarized Certificate of compliance with all of the above shall be required from the epoxy facility.

C. Welded wire fabric shall conform to the requirements of ASTM A185.

D. Reinforcing Mesh shall be new deformed wire fabric conforming to ASTM A496 and A 497

E. Epoxy-coated wire and welded wire fabric: ASTM A884, except minimum coating thickness shall be 10 mils.

F. Stainless steel pins and stainless steel rods shall conform to ASTM A276, and shall be sized as noted on the Contract Documents.

G. Reinforcement accessories, consisting of spacers, chairs, ties, and similar items shall be provided as required for spacing, assembling, and supporting reinforcement in place. All accessories shall be dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of the CRSI Standards specified in this Section.

1. Accessories shall be epoxy-coated where the spliced bars have epoxy coating per ASTM A884.
2. At all other reinforcement: For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Tie wire shall be annealed wire of sufficient strength for intended purpose but not less than 18 gauge. Supports touching interior formed surfaces exposed to view shall be CRSI Class 1, plastic protected, or CRSI Class 2, stainless steel.

H. Tie wire for reinforcement shall be 16 gauge or heavier dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of ASTM A82.

I. All tied wire for epoxy-coated reinforcing bars shall be 16.50 gauge or heavier black-annealed wire, epoxy-coated per ASTM A884.

2.03 FORMWORK, COATINGS AND ACCESSORIES

A Formwork:

1. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint locations shown on the Contract Documents. Where plywood is used, use plywood complying with U. S. Product Standard PS-1 "B-B (Concrete form) Plywood," Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark. Provide form

material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflections.

2. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable materials. Provide lumber dressed on at lease two edges and one side for tight fit.
3. Chamfer Strips: Use ½ inch, 45 degree strips, nailed 6 inches on center, and installed in inside corners of all forms, unless otherwise directed by the Landscape Architect or shown on the Contract Documents.

B. Form Coatings shall be non-grain raising and non-staining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface. Agent shall be chemically active, shall minimize surface voids, leave no residual on concrete, produce a smooth, architectural concrete surface, and shall be specifically formulated for application to the forms used by the Contractor. Coating containing mineral oils or the non-drying ingredients will not be permitted. Provide form release agent with a maximum of 350 mg/l volatile organic compounds (VOCs).

C. Form Ties and Spreaders: Standard metal form clamp assemble and plastic cone, factory-fabricated, adjustable-length, removable or snap-off metal, of type acting as spreaders and leaving no metal within one inch of concrete face. Designed to prevent form deflection and to prevent spalling of concrete upon removal. Inner tie rod shall be left in concrete when forms are removed. No wire ties or wood spreaders will be permitted. Use 1/2 inch x 1 inch plastic cones for sinkages.

2.04 RELATED MATERIALS

A. Bonding Agent system shall be an epoxy resin/Portland cement adhesive bonding agent for steel and concrete meeting ASTM C881 Bond Strength Requirements.

1. Component “A” shall be an epoxy resin/water emulsion containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component “B” shall be primarily a water solution of a polyamine.
3. Component C” shall be a blend of selected Portland cements and sands.
4. The material shall not contain asbestos.
5. Properties of the mixed epoxy resin/Portland cement adhesive
   a. Pot Life: 75-105 minutes
   b. Contact Time: 24 hours
   c. Color: dark gray
6. Properties of the cured epoxy resin/Portland cement adhesive.
   a. Compressive Strength (ASTM C109)
      i. 1 day: 810 psi minimum
      ii. 7 day: 6,000 psi minimum
      iii. 28 day: 8,000 psi minimum
   b. Splitting Tensile Strength (ASTM C496)
      i. 28 days: 540 psi minimum.
   c. Flexural Strength (ASTM C348)
      i. 1100 psi minimum
   d. Bond Strength (ASTM C882 modified) at 14 days
      i. 0 hrs. open time: 1,900 psi minimum
      ii. 24 hrs. open time: 1,500 psi minimum
7. The epoxy resin/Portland cement adhesive shall not produce a vapor barrier.
8. Material must be proven to prevent corrosion of reinforcing steel when tested under the procedures as set forth by the Federal Highway Administration Program Report No. FHWAJRD86/193. Proof shall be in the form of an independent testing laboratory corrosion report showing prevention of corrosion of the reinforcing steel.

B. Joint Filler: Where used with caulking or sealants, it shall be non-extruding, self-expanding filler strips conforming to AASHTO-M153, Type II, as manufactured by Celotex Corporation, W.R. Meadows, Inc., W.R. Grace and Company, or, approved equal.

C. Grout shall be a non-staining, non-shrink cement grout conforming to ASTM C-827 and Army Corps of Engineers Specification CRD-C-621. Grout shall contain no metals. Grout shall be one of the following or an approved equal:

1. Five Star Grout
   U.S. Grout Corporation
   401 Stillson Road
   Fairfield, CT 06430

2. Sika Grout 212
   Sika Corporation
   201 Polito Avenue
   Lyndhurst, NJ 07071

3. Harris Construction Grout
   A.H. Harris & Sons Inc.
   10 West Mill Street
   Medfield, MA 02052

D. Concrete Curing Membranes conforming to ASTM C171:

1. Polyethylene film
2. Polyethylene-coated burlap
3. Waterproof paper

E. Absorptive cover shall be burlap cloth made from jute or kenat, weighing approximately 9 ounces per square yard complying with AASHTO M182, Class 2.

F. Expansion bolts shall be hot-dipped galvanized bolts conforming to Federal Spec. FF-S-325, Group II, Type 4, Class 1. Allowable pullout and shear values shall be based on ASTM E488 spacings. Use one of the following or approved equal:

1. “Molly Parabolt”, USM Corporation
2. “Kwikbolt”, Hilti Incorporated
3. “Red head Wedge Anchor”, ITT Philips Drill Division.

G. Base material shall be as specified, provided, installed and paid for under Section, EARTH MOVING, of this Specification.

2.05 CONCRETE MIXES

A. Cast-in-place concrete shall conform to the requirements and applicable provisions of Section M4 of the MassDOT Standard Specification. Minimum 28-day compressive strength shall be 4,000 pounds per square inch (30 MPa). Slump of concrete shall be 4 inches.

1. Maximum allowable net water content is the total water in the mix at the time of mixing, including free water on aggregate.
2. Consider any fly ash as part of the cement content for purposes of establishing cement factor and w/c ratio. Limit use of fly ash to not exceed 25 percent of cement content by weight.
3. Use maximum water-cement equal to 0.45 for concrete subject to freezing and thawing, repeated surface wetting or deicers.

B. Normal weight concrete shall have an air dry weight not exceeding 150 pounds per cubic foot.

C. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Slabs, including concrete topping slabs, ramps, and sloped surfaces: Not more than 3 inches.
2. Concrete containing high-range water-reducing admixtures (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 to 3 inch slump concrete.
3. Other concrete: Not more than 4 inches.

D. Air-entraining and water-reducing agents shall be used in all concrete in strict accordance with the manufacturer's printed instructions. Total air-entrained in freshly mixed concrete shall be 5 percent plus or minus 1.0 percent of volume of concrete.

E. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed not he work, but without permitting the materials to segregate or excess free water to collect on the surface.

F. Pre-mix admixtures in solution form and dispense as recommended by the manufacturer. Include the water in the solution in the design water content of the mixtures.

G. Maximum water soluble chloride ion (C1-) in concrete: 0.10 percent by weight of cement.

2.06 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (super plasticizer) in concrete, as required by site conditions and approved by the Landscape Architect, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees Fahrenheit.

C. Use corrosion inhibitor admixture in concrete that will be exposed to a corrosive environment, including waterproofing base slab, topping and wearing slabs subject to vehicular traffic.

D. Use high-range water-reducing admixture in pumped concrete, and concrete with water-cement ratios below 0.45.

E. Use air-entraining admixture in concrete exposes to exterior environment and in accordance with manufacturer’s written instructions. Interior protected concrete may be air entrained for improved workability. See ACI 301 Table 3.4.1 for required air content except that maximum for all sizes of aggregate shall be 6 percent in exterior environments. Tolerance at point of placement shall be plus or minus one percent.

F. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer’s directions.

2.07 CONCRETE MIXING AND DELIVERY

A. Ready-Mixed Concrete: use ready-mixed concrete produced by plant acceptable to the Landscape Architect. Hand or site mixing shall not be done. Batch constituents, including admixtures, at central plant. Admixtures shall be premixed in solution form and dispensed as recommended by manufacturer. Comply with requirements of ASTM C94, and as specified.

1. When air temperature is between 85 degree Fahrenheit and 90 degree Fahrenheit, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90 degrees Fahrenheit, reduce mixing and delivery time to 60 minutes.
2. For normal weight concrete, water may be added at the site only to makeup water withheld at the plant. Batching plant shall document at the driver’s delivery ticket any water withheld at the plant. When water has not been withheld and slump is too low for proper handling of concrete, use high-range water reducing admixture to bring slump within specified range.

B. Transport ready-mixed concrete to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site within one and one-half hours after cement was first introduced into mix. Do not use concrete with a temperature greater than 85 degrees Fahrenheit (30 degrees Centigrade). Central mixed concrete shall be plant-mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit-mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged.

C. Do not re-temper (mixing with or without additional cement, aggregates, or water) concrete that has partially hardened.

PART 3 – EXECUTION

3.01 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Forms shall be so braced and tied together that the movement of men, equipment, materials, or placing and vibrating the concrete will not throw them out of line or position. Securely brace and shore forms, making them sufficiently tight, to prevent the leakage of concrete. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following A.C.I. 347 limits

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class B tolerances for all formed concrete surfaces.

B. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Openings for Items Passing through Concrete: Contractor shall establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections. Contractor shall be held responsible for proper coordination of all work of this nature in order that there will be no unnecessary cutting and patching of concrete. Any cutting and repairing to concrete required as a result of failure to provide for such openings shall be paid for by the Contractor at no additional expense to the Owner.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete~ Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

A. General: Place reinforcing steel in accordance with the Contract Documents and approved Shop Drawings. Comply with CRSI's Recommended Practice for Placing Reinforcing Bars, for details and methods of reinforcement placement and supports.

1. Install reinforcement accurately and secured against movement, particularly under the weight of workmen, the placement of concrete and vibration work.

2. Reinforcing Steel Supports: Bars shall be supported on approved plastic or dielectric-coated metal chairs or spacers, accurately placed and securely fastened to forms or steel

reinforcement in place. Additional bars shall be supplied, whether specifically shown on the Contract Documents or not, where necessary to securely fasten reinforcement in place. Support legs of accessories in forms without embedding in form surface. Spacing of chairs and accessories shall conform to CRSI's "Recommended Practice for Placing Bar Support". Hooping and stirrups shall be accurately spaced and wired to the reinforcement. No wood will be permitted inside forms. Lifting of welded wire fabric into proper position while concrete is being poured rather than supporting fabric on chairs will not be permitted.

3. Placing and Tying: All reinforcement shall be set in place, spaced, and rigidly and securely tied or wired with tie wire at all splices and at all crossing points and intersections in the positions shown, or as directed. Re-bending of bars on the job to accommodate the job to accommodate existing conditions will not be permitted without the written approval of the Owner. Point ends of wire ties away from forms.

4. Spacing: Minimum center to center distance between parallel bars shall be in accordance with the details on the Contract Documents, or, where not shown, the clear spacing shall be 2 times the bar diameter but in no case less than 1.5 inches or less than 1-1/2 times the maximum size aggregate.

5. Splices shall be in accordance with the following:
   a. Maximum 50 percent of steel spliced occurring within lap length.
   b. Splice lengths: #6 bars and smaller - 30 bar diameter

6. Protective Concrete covering
   a. Except where shown otherwise on Contract Documents, the minimum concrete coverage for steel reinforcement shall conform with the applicable revisions of the "Codes and Standards" previously specified in this Section. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

7. Dowels and Sleeves
   a. Install expansion dowels and sleeves perpendicular to and across expansion joints in concrete at 24 inches on center minimum, or as shown on the Contract Documents. Core drill existing concrete where required and grout non-sleeved end of dowel in place. After grout has set, bend dowel and sleeve as required to level before pouring new concrete.

B. Repair of Coating Damage due to Handling, Shipment, and Placing

1. Coating damage to epoxy-coated reinforcing bars and welded wire fabric due to handling, shipment, and placing need not be repaired where the damaged area is 0.063 square inches or smaller; damaged areas larger than 0.063 square inches shall be repaired. The maximum amount of damage including repaired and un-repaired areas shall not exceed 2 percent of the total surface area in each linear foot of the bar.

2. When epoxy-coated reinforcing bars or welded wire fabric wires are cut, the ends of the bars shall be coated with the same material used for repair of coating damage.

3. Prepare surfaces and repair, using the approved patching material, in strict accordance with the instructions furnished by the patching material manufacturer.

C When required or permitted, mechanical connections shall be installed per manufacturer’s recommendations. After installation of mechanical connections on epoxy-coated reinforcing bars, coating damage shall be repaired in accordance with the requirements of this Section for repair of coating damage due to handling, shipment and placing. All parts of mechanical connections used on coated bars, including steel splice sleeves, bolts, and nuts shall be coated with the same material used for repair of rebar coating damage.

D. Do not bend, tack weld or cut reinforcement in field in any manner other than as shown on Contract Documents unless specific approval for each case is given by Landscape Architect.

E. Continue reinforcement through construction joints unless otherwise indicated on Contract Documents.

F. Splice reinforcement only in accordance with requirements of Contract Documents or as otherwise specifically approved by Landscape Architect. Do not splice reinforcement at points of maximum stress unless shown on the Contract Documents.

G. Clean epoxy-coated and other reinforcement of earth, ice, and other materials that reduce or destroy bond with concrete; also clean uncoated reinforcement of loose rust and mill scale. Paint reinforcement expected to be exposed to weather for a considerable length of time with a heavy coat of cement grout. Protect stored materials so as not to bend or distort bars in any way. Bars that become damaged will be rejected.

H. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by the Landscape Architect.

I. Installing Epoxy Adhesive Anchored Rebar Dowels

1. Drill and prepare holes in accordance with Epoxy Adhesive manufacturer’s written instructions.
2. Mix and place epoxy adhesive, in accordance with manufacturer’s written instructions.
3. Clean reinforcing dowels thoroughly, and as a final step clean portion to be embedded with a solvent.
4. Install dowel bar(s) in hole so that bar(s) is centered in the hole and the epoxy adhesive completely surrounds the bar(s).
5. Take care to avoid any disturbance of the dowel bar(s) until epoxy is hardened.

J. Install welded wire fabric in lengths as long as practicable Lap adjoining pieces by 12 inches and as indicated and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

K. Before concrete is cast, check all reinforcement after it is placed to insure that reinforcement conforms to Contract Documents and approved Shop Drawings. Such checking shall be done only by qualified experienced personnel. In addition, notify the Landscape Architect at least 36 hours prior to concrete placement so a visit may be made to observe completed reinforcement and formwork before concrete placement.

3.03 JOINTS

A. Construction Joints

1. Construction joints shall be placed a maximum of 40 feet apart. The Contractor shall prepare a placing plan for location of construction joints and submit it to the Landscape Architect for approval. Locate and install construction joints so they do not impair strength or appearance of the structure. Where a joint is to be made, the surface of the concrete shall be sandblasted or thoroughly picked, thoroughly cleaned, and all laitance removed. In addition to the foregoing, joints shall be thoroughly wetted, but not saturated, and slushed with a coat of grout immediately before the placing of new concrete. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Forms shall be re-tightened before placing of concrete is continued. There shall be an interval of at least 48 hours between adjacent pours.

B. Expansion Joints

1. Expansion joints in walls or wall caps shall include joint sealant and installed as indicated on Contract Documents. Expansion joints shall be placed a maximum of 30 feet on center in walls and wall caps. Expansion joints shall be 1/2 inches wide. Follow manufacturer's recommendations for filler and sealant.

3.04 INSTALLING EMBEDDED ITEMS

A General: Set and build into formwork anchorage devices, sleeves, and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Conform to requirements of ACI 318, paragraph 6.3, Conduits and Pipes Embedded in Concrete".

C. Install anchor bolts for column base plates in accordance with AISC Code of Standard Practice, Paragraph 7.5 and the following: Use setting plate templates. Maintain elevations and plan locations of bolt groups within ¼ of an inch of the locations shown on the Contract Documents. Place individual bolts in a bolt group within 1/8 of an inch of center-to-center dimensions shown on the Contract Documents.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

E. Complete cooperation shall be extended suppliers of embedded items in their installation. Secure information for embedded items from other trades as required. All embedded items shall be securely anchored in correct location and alignment prior to placing concrete.

3.05 PREPARING FORM SURFACES

A General: Coat contact surfaces for forms with an approved form-coating compound before placing reinforcement.

B Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.
2. Do not coat steel deck in composite steel deck and concrete slabs.

3.06 CONCRETE PLACEMENT

A. Inspection Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete", and as specified.

C. If concrete pumping is proposed, refer to "Submittals" paragraph in this Section for requirements. Concrete may be placed into the pump at the maximum but not more than the specified slump.

D. Remove water and foreign matter from forms and excavations and, except in the freezing weather or as otherwise directed, thoroughly soak wood forms just prior to placing concrete. Place no concrete on frozen substrate, and provide adequate protection against frost action during freezing weather.

E. To secure bond at construction joints, thoroughly clean concrete surfaces with water jet or compressed air. Just before new concrete is deposited, saturate joint surface with water for not less than 2 hours, leaving surface without free or glistening water.

F. Do not place concrete having slump outside of allowable slump range. The loss of slump between pump and discharge end of pipeline shall not exceed 2 inches.

G. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcement, and which avoid re-handling. Deposit no partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and U-shaped design as to insure continuous flow in chute. Do not use flat (coal) chutes, Use metal or metal-lined chutes with different portions having approximately the same slope. Slope shall not be less than 25 degrees nor more than 45 degrees from horizontal. Use a baffle or spout at the discharge end of the chute to prevent segregation. If discharge end of chute is more than 5 feet above surface of concrete in forms, use spout with its lower end at surface of deposit. When operation is intermittent, discharge chute into hopper. Do not allow concrete to flow horizontally over distances exceeding 5 feet.

H. Place concrete in such manner as to prevent segregation and accumulations of hardened concrete on forms or reinforcement above mass of concrete being placed. To achieve this end, use suitable hoppers, spouts with restricted outlets and tremies as required.

I. During and immediately after depositing, compact concrete in accordance with ACI 309 by means of internal type mechanical vibrators or other tools to produce required quality of finish. Vibration shall be done by experienced operators under close supervision and shall be performed only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or 'pumping' of air. Vibrators used for normal weight concrete shall operate at speed of not less than 7,000 rpm and be of suitable capacity. Do not use vibrators to move concrete. Keep at least one vibrator on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting placement.

J. Place vertical lifts to not exceed 18 inches. Vibrate through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.

K. Deposit concrete continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, introduce a joint and additional reinforcement so as to preserve structural continuity. Notify Landscape Architect in any such case.

L. Cold joints, particularly in exposed concrete, including 'honeycomb", are unacceptable. If they occur, Landscape Architect may require that entire section in which such defect occurs be removed and replaced with new materials at Contractor's expense

M. When placing exposed concrete walls or beams, strike corners of forms rapidly and repeatedly from outside along full height while depositing concrete and vibrating.

N. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

O. Clean chutes, hoppers, spouts, adjacent work, etc. before and after each run; discharge water and debris outside form.

P. Temperature of the concrete mix should be between 50 degrees Fahrenheit and 85 degrees Fahrenheit and it should not vary more than approximately 10 degrees Fahrenheit from the temperature of the concrete against which it is placed.

Q. Cold-weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

R. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees Fahrenheit and not more than 80 degrees Fahrenheit at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
3. Concrete and formwork must be kept at a temperature of not less than 50 degrees Fahrenheit for not less than 96 hours after placing.

S. Hot-weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 85 degrees Fahrenheit. Mixing water may be chilled or chipped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. No concrete shall be deposited when the air temperature is greater than 90 degrees Fahrenheit.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
4. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas
5. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to the Landscape Architect.

T. No water shall be add to the mix on site.

3.07 FINISHING FORMED SURFACES

A. Concrete Finish Schedule

1. Exposed Horizontal Surfaces
   a. Exposed horizontal concrete surfaces subject to pedestrian foot traffic shall receive a non-slip broom finish after troweling.
2. Exposed Vertical Surfaces
   a. Exposed vertical surfaces shall have a smooth-formed finish.
3. Hidden Vertical Surfaces
   a. Hidden vertical surfaces shall be rough-formed.

B. Definitions

1. Non-slip Broom Finish: Apply a non-slip broom finish to all slabs subject to vehicular traffic, loading dock platforms, exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
   a. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route Coordinate required final finish with the Landscape Architect before application.

2. Smooth Trowel Finish: At tops of walls and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 MISCELLANEOUS CONCRETE ITEMS

A. Ready-mix or transit-mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities for the respective conditions as stated on the nameplate. Discharge at the site shall be within 1-1/2 hours after cement was first introduced into the mix. Central mixed concrete shall be plant-mixed a minimum of 1-1/2 minutes per batch and then shall be truck-mixed or agitated a minimum of 8 minutes. Agitation shall begin immediately after the pre-mixed concrete is placed in the truck and shall continue without interruption until discharge. Transit-mixed concrete shall be mixed at mixing speed for at least 10 minutes immediately after charging the truck, followed by agitation without interruption until discharged.

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B. Concrete trucks will not be allowed to wash out into the town drainage system. A concrete wash out bag shall be used such as an EnviroSac or equal product.

C. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

D. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Contract Documents. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.09 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Where corrosion inhibitor admixture has been used, provide continuous water-fog spray or mist or evaporation retardant to prevent plastic shrinkage cracks during initial setting time. In hot, dry and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing Weather permitting, keep continuously moist for not less than 7 days

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch (100 mm) lap over adjacent absorptive covers.

E Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches (75 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F Apply curing compound on slabs, concrete toppings, equipment pads and curbs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including tops of beams, and other flat surfaces, by applying the appropriate curing method.

3.10 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring, and as specified

B. Remove shores and re-shore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

3.11 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees

Fahrenheit for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of its specified 28-day minimum compressive strength Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

D. All forms and miscellaneous appurtenances shall be removed from concrete prior to the closeout of the work.

3.12 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated. or otherwise damaged form-facing material will not be acceptable for exposed concrete surfaces. Apply new form-coating compound as specified for new formwork

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure Joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to the Landscape Architect.

3.13 CONCRETE SURFACE REPAIRS

A. Intent of this Specification is to require forms, mixtures of concrete, and workmanship to be of the very best quality so that final, stripped concrete surfaces will require no patching, except for plugging of tie holes.

B. Clean and dampen tie holes and fill solid with patching mortar immediately after form removal.

C. Patching Defective Areas: Patch and repair defective areas, as specified, only after examination and approval by the Landscape Architect. Repair and patch as soon as possible after removing forms, in compliance with ACI 301 Chapter 9 and as specified in this Section.

D. Mix dry-pack mortar, consisting of one part Portland Cement to .5 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1 Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. If honeycomb exists around reinforcement, chip to provide clear space at least 3/4 inch wide all around steel to ensure proper bond thereto. Thoroughly clean, dampen with water, and brush-coat the area to be patched with epoxy adhesive. Place patching mortar before epoxy adhesive has dried. Repairs thicker than one and 1/2 inch shall be built-up on successive days, each layer of 1-½ inches being applied as described in ACI 301 Chapter 9.

2. Remove and replace patches that become crazed, cracked, or sound hollow upon tapping, at Contractor’s expense.

E. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Landscape Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar

1. Repair concealed formed surfaces containing defects that affect the concrete’s durability. If defects cannot be repaired, remove and replace the concrete.

F. Repairing Unformed Surfaces (except concrete pavements): Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish.

Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used subject to the approval of the Landscape Architect.

4. Repair defective areas, except random cracks and single holes not exceeding one-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

G Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for at least 72 hours.

H. Perform structural repairs with prior approval of the Landscape Architect for method and procedure, using specified epoxy adhesive and mortar.

I. Repair methods not specified above may be used, subject to acceptance of the Landscape Architect.

3.14 ACCEPTANCE STANDARDS

A. The following concrete work shall be considered defective and may be ordered by the Owner to be removed and replaced at Contractor's expense:

1. Incorrectly formed.
2. Not plumb or level.
3. Not specified strength.
4. Containing rock pockets, voids, honeycomb, or cold joints.
5. Containing wood or foreign matter.
6. Surface texture does not conform to the requirements of the Contract Documents.
7. Forms and miscellaneous appurtenances not removed.
8. Otherwise not in accordance with the intent of the Contract Documents.

END OF SECTION 03 30 00
CAST-IN-PLACE CONCRETE

Section 04 30 00: SITE MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SECTION INCLUDES

A. The Work of this Section consists of providing all labor, materials, equipment, incidental work and construction methods necessary to furnish and install the work of this Section, including but not limited to the following:

1. Resetting stockpiled curbing
2. Granite curb
3. Rounded granite curb

1.03 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 32 Section – TREE PRUNING & REMOVAL
2. Division 32 Section – REINFORCED CONCRETE PAVEMENT
3. Division 32 Section – ASPHALT PAVEMENT
4. Division 32 Section – SITE IMPROVEMENTS

1.04 SUBMITTALS

A. Submit the following under provisions of Division 01 Section, SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications and installation instructions.
2. Shop drawings
3. Constructed Sample Panels

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to the site, until all specified submittals have been submitted to, and approved by, the Landscape Architect.

B. Store products inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.06 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Society for Testing and Materials (ASTM):
   - C 97 Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
   - C 99 Test Methods for Modulus of Rupture of Dimension Stone
   - C 119 Standard Terminology Relating to Dimension Stone
   - C 170 Test Method for Compressive Strength of Dimension Stone
   - C 241 Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic

C 503 Standard Specifications for Marble Dimension Stone (Exterior)
C 568 Standard Specification for Limestone Dimension Stone
C 615 Standard Specification for Granite Dimension Stone
C 629 Standard Specification for Slate Dimension Stone
C 880 Test Method for Flexural Strength of Dimension Stone

B. National Building Granite Quarries Association, Inc. (NBGQA):
Specifications Specifications for Architectural Granite

C. Massachusetts Department of Transportation (MassDOT):
Specifications Standard Specifications for Highways and Bridges

D. Laws, Codes, and Regulations: Work of this Section shall comply with applicable federal, state, and local laws, codes, and regulations.

1.07 SUBMITTALS

A. Provide the following submittals under provisions of Division 01 Section, SUBMITTAL PROCEDURES for all masonry items specified under this Division 32 Section, SITE MASONRY, including:

1. Granite curb – all

B. Manufacturer's Product Data: Manufacturer's product data for stone, stone accessories, and other manufactured products specified, including but not limited to product specifications and installation instructions.

1. For stone variety proposed for use on the Project, include data on its physical properties required by referenced ASTM standards.

C. Shop Drawings showing details of stone pieces to be provide indicating: cross-sections, elevations showing layout of all pieces, sizes, dimensions, finishes, arrangement and provisions for jointing, anchoring, cut-out and holes, and other necessary details for reception of other work.

1. Shop Drawings shall indicate locations of inserts for stone anchors and supports which are to be built into concrete, and locations and dimensions of cut-outs, holes, openings, and other provisions required for the work of other trades.

2. Shop drawings shall indicate the setting number of each piece and each piece shall bear the corresponding number in a non-staining paint.

3. Shop Drawings should call out all dimensions, identification of specific products and materials that are included in the work, compliance with specified standards, and notations of coordination requirements with other work. Contractor shall provide special notation of dimensions that have been established by field measurement. Highlight, circle or otherwise indicate deviations from the Contract Documents on the shop drawings. Shop Drawings shall include granite finishes and nosing dimensions.

C. Samples: Provide stone samples for verification shall show color, grade, finish, nosings and variety of each stone type required for the Project. Stone samples shall be not less than 6 inches by 6 inches by 1 inch in size, unless indicated otherwise. Submit one or more samples for each of the following items, showing full range of variations in appearance characteristics expected in completed Work:

1. Mortar samples - Submit as many samples as necessary until color and finish acceptable to Landscape Architect and/or Owner.

E. Masonry Cleaning Work Description: Prior to any masonry cleaning work on site, submit detailed description of proposed materials and procedures for each substrate and condition requiring masonry cleaning. Submit new written descriptive information.

Photocopies of Contract Documents, excerpts from Contract Documents, and/or duplication of text in Contract Documents will not be accepted for Work Description. Do not begin work on site until work description has been approved in writing. Description for each condition shall include, but not be limited to:

1. Cleaning: Materials, methods, tools, and equipment for each type of masonry cleaning specified herein.

2. Protection: Description, including drawings, of proposed materials and methods of protection for preventing harm, damage, and deterioration caused by work of this Section to persons (whether involved in the Work or not); building elements, materials, and finishes; surrounding plants, landscape, and site; and the environment (including air and water).

2. Alternate Masonry Cleaning Methods and Materials (If Any): Contractor proposed alternate methods and materials (if any) to those specified for any phase of masonry cleaning. Provide evidence of successful use on comparable projects and demonstrate effectiveness for use on this Project.

4. Waste Disposal Program: Prior to commencing masonry cleaning operations, submit a written description of proposed materials and methods for collection, treatment, and disposal of wastes resulting from masonry cleaning operations.

1.08 MOCK-UPS

A. General: Before beginning general masonry cleaning work, prepare mock-ups to provide standards for work of this Section. Do not proceed with masonry cleaning until Landscape Architect has approved mock-ups.

1. Locate mock-ups as directed by Landscape Architect.
2. Notify Landscape Architect 48 hours prior to start of each mock-up.
3. Landscape Architect will monitor mock-ups. Mock-ups not performed in presence of Landscape Architect will be rejected.
4. Use crew that will perform the work and follow requirements of this Section.
5. Repeat mock-ups as necessary to obtain Landscape Architect's approval.
6. Allow mock-ups to dry for one week to allow natural color to return and problems to appear. Notify Landscape Architect when mock-ups are ready for inspection.
7. Protect approved mock-ups to ensure that they are without damage, deterioration, or alteration at time of Substantial Completion.
8. Approved mock-ups in undamaged condition at time of Substantial Completion may be incorporated into the Work.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following, or equal.

B. Single Source: All work of this Section shall be produced by a single manufacturer, unless otherwise approved by the Landscape Architect.

2.02 GRANITE – GENERAL

A. Granite shall be sound and uniform in quality, texture, appearance and strength, extracted from contiguous locations in a single bed of quarry stratum, and shall be free of flaws, reeds, rifts, laminations, cracks, seams, starts, or other defects that may impair its strength, durability, function, or appearance. Exposed surfaces shall be free from spots, spalls, chips, stains, discoloration, or other defects that would affect its appearance.

D. Source of Granite:

1. Use only one quarry source and granite material for the following granite work throughout the entire project.

E. Granite Properties: Unless otherwise indicated granite as supplied shall meet or exceed the following:

1. Bulk Density (ASTM C 97): 182.6 pounds per cubic foot, average.
2. Absorption (ASTM C 97): 0.12 percent, average.
3. Compressive Strength (ASTM C 170): 29,000 pounds per square inch, average.
4. Modulus of Rupture (ASTM C 99): 2,385 pounds per square inch, average.

F. Granite Fabrication:

1. Size and Dimension: Granite shall be fabricated accurately in the sizes, shapes and dimensions indicated on the Contract Documents and approved Shop Drawings.

2. Back of granite which will be concealed in the finished work shall be sawn to approximately true planes. Maximum variation in thickness shall be 3/8 inch. Sawn backs shall be cleaned of rust stains and iron particles.

3. All faces shall be at right angles to the plane of the top, unless indicated otherwise.

4. Holes, cut-outs, sinkages and openings in granite work for scuppers, spillways, weepholes, anchors, cramps, dowels, supports, and lifting devices, shall be accurately cut or drilled to required dimensions, as shown on the approved Shop Drawings, and as necessary to secure granite in place to insure correct location and accurate fit of all fixtures.

5. Arrises shall be cut sharp and true to square, and continuous with adjoining arrises. Where exposed, arrises shall be eased as shown on the Contract Documents and approved Shop Drawings.

6. Flatness Tolerance: Variation from true plane, or flat surfaces, shall be determined by use of a 4 foot long straightedge, applied in any direction on the surface. Such variations on polished, honed and fine rubbed surfaces at the bed and joint arris lines shall not exceed 3/64 inch or 1/16 of the specified joint width, whichever is greater. On surfaces having other finishes the maximum variation from true plane shall not exceed 1/4 of the specified joint width.

7. Variations for true plane on face surfaces shall not exceed the following:
   a. Thermal finish: 3/16 inch

8. Comply with recommendations of National Building Granite Quarries Association's (NBGQA) "Specifications for Architectural Granite."

9. Perform no cutting or finishing of stone until approved Shop Drawings have been received and reviewed from the Landscape Architect.

2.03 GRANITE CURB

A. Contractor shall reuse granite curb available on site. Conditions of existing granite curb to be reviewed by the Contractor and approved by the Landscape Architect.

B. Granite curb shall be as noted herein and fabricated to the sizes and dimensions indicated on the Contract Documents and approved Shop Drawings.

C. Granite curb shall be MassDOT curb Type VA4 (6 inches wide by 17 to 19 inches by 72

inches length), with reveal as designated on the Contract Drawings.

C. Granite curb shall be “Chelmsford” granite, or an approved equal fine grained, light gray granite.

D. The granite curb concrete base and footing shall be as specified, installed and paid for according to Division 32 Section, CAST-IN-PLACE CONCRETE.

2.04 ROUNDED GRANITE CURB

A. Contractor shall reuse granite curb available on site. Conditions of existing granite curb to be reviewed by the Contractor and approved by the Landscape Architect.

B. Rounded granite curb shall be as noted herein and fabricated to the sizes and dimensions indicated on the Contract Documents and approved Shop Drawings. Dimensions shall match existing rounded granite curb. Radii shall be as noted on Contract Drawings.

C. Granite color and finish shall match existing rounded granite curb.

D. The granite curb concrete base and footing shall be as specified, installed and paid for according to Division 32 Section, CAST-IN-PLACE CONCRETE.

2.05 CONCRETE

A. Concrete footings shall be 4,000 pounds per square inch (30MPa) cast-in-place concrete. Concrete pads shall be 3,000 pounds per square inch (20MPa) cast-in-place concrete.

B. Cast-in-place concrete for pads and footings shall be as specified and paid for under the work of Division 03 Section, of this Specification.

2.06 MORTAR SETTING BED

A. Setting bed mortar shall be a mixture of a premixed, prepackaged sand/cement dry mix and a latex polymer additive as follows:

1. Sand cement mixture shall be equal to Laticrete 226 manufactured by Laticrete International, Inc., Bethany, CT 06524. Deliver Laticrete 226 to the job site in unopened bags.
2. Latex polymer additive shall be equal to Laticrete 3701 setting liquid, manufactured by Laticrete International, Inc., Bethany, CT 06524. Mix according to manufacturer’s instructions. Add latex polymer additive to sand/cement mixture to achieve the desired consistency.

2.07 MORTAR FOR POINTING

A. Mortar grout for pointing of joints shall be as manufactured by Laticrete International, Inc., Bethany, CT 06524. or approved equal, and shall be comprised of the following components

1. Laticrete 500 Series Sanded Grout with color-fast pigments. Color of each of grout shall be approved by Architect prior to installation.
2. Latex polymer additive shall be equal to Laticrete 3701 setting liquid, manufactured by Laticrete International, Inc., Bethany, CT 06524.

2.08 GROUT

A. Grout as required for anchoring shall conform to ASTM C-827. Grout shall be a pourable, quick setting, non-metallic and non-shrinking hydraulic cement grout equal to the following, or an approved equal:

1. Five Star Grout

U.S. Grout Corporation
401 Stillson Road Fairfield, CT 06430
(800) 243-2206

2. Sika Grout 212
Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
(201) 933-8800

3. Harris Construction Grout
A.H. Harris & Sons, Inc.
10 West Mill Street Medfield, MA 02052
(508) 359-7321

2.09 WATER

A. Water shall be potable and shall be free of injurious contaminants.

2.10 ACCESSORIES

A. Epoxy: Bonding Agent system shall be an epoxy resin/Portland cement adhesive bonding agent for steel and concrete meeting ASTM C881 Bond Strength Requirements.

1. Component “A” shall be an epoxy resin/water emulsion containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component “B” shall be primarily a water solution of a polyamine.
3. Component C” shall be a blend of selected Portland cements and sands.
4. The material shall not contain asbestos.
5. Properties of the mixed epoxy resin/Portland cement adhesive
   a. Pot Life: 75-105 minutes
   b. Contact Time: 24 hours
   c. Color: to be reviewed and approved by Architect.
6. Properties of the cured epoxy resin/Portland cement adhesive.
   a. Compressive Strength (ASTM C109)
      i. 1 day: 810 psi minimum
      ii. 7 days: 6,000 psi minimum
      iii. 28 days: 8,000 psi minimum
   b. Splitting Tensile Strength (ASTM C496)
      i. 28 days: 540 psi minimum
   c. Flexural Strength (ASTM C348)
      i. 1100 psi minimum
   d. Bond Strength (ASTM C882 modified) at 14 days
      i. 0 hrs. open time: 1,900 psi minimum
      ii. 24 hrs. open time: 1,500 psi minimum
7. The epoxy resin/Portland cement adhesive shall not produce a vapor barrier.
8. Material must be proven to prevent corrosion of reinforcing steel when tested under the procedures as set forth by the Federal Highway Administration Program Report No. FHWAJRD86/193. Proof shall be in the form of an independent testing laboratory corrosion report showing prevention of corrosion of the reinforcing steel.

C. Joint sealant: Shall be specified, provided, installed and paid for under the Division 07 Section: JOINT SEALANTS, of this Specification.

2.11 MASONRY CLEANING OF SALVAGED GRANITE CURB & ROUNDED GRANITE CURB

A. Alternate Masonry Cleaning Methods: If Contractor proposes use of cleaning procedures and products other than those specified and the Landscape Architect gives preliminary approval following required submittals, Contractor shall perform tests and create mock-ups demonstrating ability of proposed products and procedures to produce

specified cleaning results and for comparison with specified mock-ups at no additional cost. No alternate method shall be permitted until Designer has approved it.

B. Prohibited Materials and Methods: The following methods are strictly prohibited and shall not be used for work of this Contract: sandblasting, steam and use of nonproprietary acids, alkalis, and other products not formulated specifically as products for masonry cleaning.

C. General: Provide products by the following manufacturers or approved equals.

1. Chemique, Inc., 315 North Washington Avenue, Moorestown, NJ 08057 (800-225-4161)

2. Diedrich Technologies, Inc., 7373 South 6th St., Oak Creek, WI 53154 (800-323-3565)

3. Dumond Chemicals, Inc., 104 Interchange Plaza, Suite 202, Monroe Township, NJ 08831 (800-245-1191)

4. Dynacraft Industries (Back to Nature Products Co.), 4 Kinney Road, Englishtown, NJ 07726 (732-303-8920)

5. Hydrochemical Techniques, Inc. 253 Locust Street, Hartford, CT 06114 (800-278-7681)

6. ProSoCo, Inc., 3741 Greenway Circle, Lawrence, KS 66046 (800-255-4255).

D. Equipment for water rinsing: Provide all equipment and accessories to distribute water at pressures and flow rates required for masonry cleaning.

1. Pressure Pumps: Pressure pumps capable of producing water flow at a rate of 6 gallons per minute at a pressure of 800 psi at nozzle on end of hose. Pumps, or a combination of pumps plus pressure reducing valves, shall have capability of providing water at a steady pressure and flow rate at all pressures from 100 psi to 800 psi. Pumps shall have working pressure gauges. Pumps found to be without working pressure gauges shall be removed from site, and work shall cease until pumps have been replaced with pumps having working pressure gauges. Pumps shall have no ferrous elements in contact with liquid stream.

2. Particulate Filter: Provide a 5-micron particulate filter in line with water supply. All water used for masonry cleaning shall be filtered.

3. Replace particulate filter as required to provide filtered water with no particles greater than 5 microns at pressure and flow rate specified.

4. In-line Pressure Gauges: Each water line used for pressure rinsing shall have a working pressure gauge within 15 feet of nozzle used for rinsing.

5. Spray Nozzles for Pressure Rinsing: Nozzles shall be of nonferrous metal and shall have a minimum 15-degree fan tip.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of existing project conditions.

3.02 PREPARATION

A. Field Measurements: Verify and coordinate the locations of the following:

1. As-constructed concrete footings, concrete bases or other base dimensions.
2. All other items affecting the completion of the work.

B. Advise installers of other work about specific requirements relating to placement of inserts which are to be used for anchoring and supporting of stone. Furnish installers of other work with Drawings or templates showing location of inserts for anchors and supports.

C. Concrete surfaces which are to receive the mortar setting bed shall be cleaned of debris and broomed down to produce a clean acceptable surface free from grease, oil or other surface materials which might retard or prevent the bonding and/or set of the mortar.

D. Clean the surfaces of each stone before setting, removing foreign matter that might impair the bedding, bonding or appearance of the work. During setting operations dirt or setting materials in contact with exposed surfaces of the stone work shall be immediately removed.

E. Do not set patched, chipped, cracked, broken or other defective pieces of stone work. Stains which cannot be removed with clean water and fiber brushes shall be considered a defect, and such pieces shall not be used.

F. Surfaces to which this work is to be secured and the stone surfaces themselves, shall be free from frost, wetness, dirt, grease, visible rust and foreign materials which will be detrimental to the proper execution of the work.

3.03 PROTECTION

A. Protect installed products and adjacent construction until completion of project. Protect adjacent work areas and finish surfaces from damage during installation.

B. Cover the top of unfinished stone masonry work to protect it from the weather. Prevent staining of stone from mortar, grout, sealants and other sources. Immediately remove such materials from masonry.

3.04 MORTAR BEDDING AND JOINTING

A. Granite unit installation: Set units in full bed of mortar fill dowel, anchor, and similar holes solid. Apply enough mortar at bed to allow mortar to be forced out both sides of the face shell. Wet unit joint surfaces thoroughly before setting. For masonry unit surfaces that are soiled, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

B. Joints: Unless otherwise indicated, provide butt tight, vertical joints.

3.05 MORTAR PROPORTIONING AND MIXING

A. Except as otherwise specified in this Section, conforms to the property and proportion requirements of ASTM C270 for all mortar.

B. Mortar for all masonry shall be Type M with integral waterproofing added in proportions recommended by the manufacturer, and integral colorant proportions to match joints of approved color.

C. Measurements: Proportions shall be by volume. One bag of Portland cement (94 pounds) shall be considered as one cubic foot; one bag of lime (50 pounds) as 1-1/4 cubic feet; and sand shall be measured in dry condition (90 pounds being equal to one cubic foot).

D. Measurements: Proportions shall be by volume. One bag of Portland cement (50 kg) shall be considered as 0.0327 cubic meters; one bag of lime (25 kg) as 0.039 cubic meters; and sand shall be measured in dry condition (50 kg being equal to 0.035 cubic meter).

A. Mixing: Mortars shall be machine-mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. Where hydrated limes are used for mortars requiring a lime content, the materials for each batch shall be well-raked and turned over together before the water is added until the even color of the mixed materials indicates that the cement materials have been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained. The same mortar mixture shall be used for all similar work.

E. The color of mortar shall be strictly controlled to assure uniformity of color through the work.

F. The method of measuring materials shall be such that the specified proportions of the materials can be controlled and accurately maintained. Shovel measurement will not be allowed.

G. All cement materials and aggregates shall be mixed at least 3 minutes in the mixer with the minimum amount of water required to produce a workable consistency. Hand mixing shall not be used unless specifically approved.

H. Mortar that has begun to set or which is not used within 2-1/2 hours after initial mixing shall be discarded. Mortar that has stiffened due to evaporation within the 2-1/2 hour period shall be re-tempered to restore its workability. Re-tempering mortar that has partially hardened without additional cement aggregate or water will not be permitted.

I. Grout for Masonry: Except as otherwise specified grouting and poured fills shall conform to ASTM C270, Type M. Grout shall have the minimum quantity of water required to produce suitable consistency for pouring and shall be continuously stirred to prevent segregation of the aggregate. Slump shall not exceed 10 inches.

J. Mortar boxes and all tools shall be thoroughly cleaned at the end of each day's work, and between batches.

3.06 GROUTING

A. Grout metal items embedded or built into masonry work solidly with grout or mortar materials.

B. Grout around sleeves, pipes, and all other items that pass through masonry walls solidly with mortar materials. Place grouting to be air tight and to prevent air leakage.

C. Fill vertical cells of masonry units solid with grout that have anchoring, reinforcing, supporting, or hanging devices embedded in the cell

3.07 INSTALLATION – GENERAL

A. Install materials in accordance with manufacturer’s instructions and direction from authorities having jurisdiction. Install miscellaneous specialties absolutely level and in true line, with units securely anchored to the surrounding construction.

B. Install materials using skilled workmen, in accordance with recommendations of the stone supplier, the Contract Documents and approved Shop Drawings and direction from authorities having jurisdiction. Install miscellaneous specialties absolutely level and in true line, with units securely anchored to the surrounding construction.

C. Delivery, storage and handling of stone at the Project site shall be as specified, performed and paid for under the work of this Section, SITE MASONRY.

D. Installation of all stone shall be as specified, performed and paid for under the work of this Section, SITE MASONRY, of this Specification.

E. Before being set, clean all stone so it is free of ice and frost. Remove dirt and other foreign materials which will cause hindrance during the erection and installation operations.

B. Set each piece in accordance with and to the elevations noted on the Contract Documents and approved final Shop Drawings.

1. All pieces shall be set straight, true to line and plumb. Set stone to comply with Drawings and approved Shop Drawings. Match for color and pattern by using units numbered in sequence as indicated on approved Shop Drawings. Replace any damaged units.
2. Allowable tolerances:
   Maximum variation from true surface level for walls:
   a. Unit-to-unit tolerance: one-eighth inch.
   b. Surface, overall tolerance: 0.25 inch in 10 feet in any direction when tested with a 10-foot straightedge.
3. Provide anchors, supports, fasteners, and other attachments shown on the contract documents and approved shop drawings to secure each piece in place as pieces are installed. Completely fill holes, slots and other sinkages for anchors, dowels, fasteners, and supports with non-shrinking, non-staining mortar during setting of stones.

D. Cover and protect all unfinished work when not being worked on, by means of waterproof paper, tarps, or other means.

3.08 INSTALLATION OF GRANITE CURB

A. No pavers shall be laid in inclement weather or when the temperature is 36 degrees Fahrenheit, and dropping, nor shall any work be done on rising temperatures until the temperature reaches 32 degrees Fahrenheit. Frozen mortar materials shall not be used.

B. Granite banding shall be set on a mortar setting bed over a prepared concrete base slab. All setting shall be done by competent masons under adequate supervision. Do any cleaning necessary to cement concrete base to provide a clean base surface, free from dust, oil, grease, other impurities, or loose or friable particles.

1. Granite banding and precast concrete pavers shall be installed hand tight with maximum joints as follows: 1/16" maximum joint.

C. Damp the surface immediately before placing the mortar setting bed, but do not allow free water to remain on the surface.

D. Granite banding with chips, cracks, stains, or other defects that might be visible in the finished work shall not be used.

E. Bond coat shall be applied to concrete base slab as a slurry by using flat side of a trowel. Thickness of bond coat shall be approximately 1/16 inch. Press bond coat firmly into the base slab. Apply as much bond coat as can be covered with mortar setting bed in 15 to 20 minutes.

F. Mortar bed equal to Laticrete 226 and 3701 shall be spread evenly over the troweled bond coat. Mortar setting shall be 1/2-inch thick, minimum. Screed mortar setting bed to a smooth and consistent surface. Let mortar bed harden sufficiently to walk upon, typically 24 hours. A second application of the bond coat mixture shall be applied to mortar setting bed using flat trowel to thickness of 1/16 inch. Comb on additional bond coat with notched sides of trowel. Back butter bricks with bond coat to ensure a full bond between pavers and setting bed.

G. Before setting, the back of each piece of granite shall be dampened. Each piece shall be carefully bedded into a wet, sticky bond coat mixture and tapped home to a full and solid bearing. Particular care shall be exercised to equalize bed and joint openings and eliminate the need for redressing of exposed surfaces.

H. Granite banding shall be set true to the required lines and grades in the pattern detailed on the

Contract Documents. Granite banding shall be neatly cut and fitted at all perimeters and closures to fit neatly and closely, with joints uniform in thickness. Pavers shall be cut with a water-cooled, cut-off wheel masonry saw using a diamond carbide blade.

I. Exposed surfaces of pavers shall be kept free from bed mortar at all times. Any bed mortar smears shall be immediately removed with a clean sponge and clean water before latex modified mortar can set.

J. Banding shall be set true to the required lines and grades in the pattern detailed on the Contract Documents. After pavers have been placed level the pavers with a suitable s t r a i g h t edge in a circular motion over the pavers to confirm that there is a continuous and even alignment between payers. If pavers are not in the required alignment, remove and reset as required to bring them to the required lines and grades. Leveling of the pavers shall be done as the setting operation proceeds so that it is not necessary to disturb the payers set earlier.

K. Joints shall be hand tight, butt joint. Stone dust joint filler shall be swept dry into the joints between pavers until the joints are completely filled. Surface shall be swept clean. Swept surface shall than be thoroughly dampened with a low-volume fine spray of water.

1. Sweep stone dust into paver joints until joints are filled solid. Fog lightly with water and repeat a minimum of three times or until joints are compacted and full.
2. Prior to acceptance, the paved area shall be flooded with water to assure that there are no depressions. Pavers with top surfaces greater than 1/16 inch above or below adjacent pavers shall be removed and reset. Remove and reset pavers as required until surface is true to line and grade. Refill sand joints as necessary until all joints are filled to finish grade.

3.09 ADJUSTING STONE PIECES

A. Remove and replace stained and otherwise damaged stone units and stone units not matching approved Samples. Stone pieces may be repaired if methods and results are approved by the Landscape Architect.

B. Replace units in a manner that results in stone pieces matching approved samples, complying with other requirements, and showing no evidence of replacement.

3.10 CLEANING OF WORK

A. During the progress of the Work, keep the exposed surfaces of masonry clean at all times and protected against damage. As each segment of the new masonry is erected, dry-brush the surfaces free of mortar spots and dropping. Remove mortar fins and smears from masonry before tooling joints.

B. Prior to final cleaning work, examine all face joints in new exposed masonry to locate cracks, holes or other defects and point up all such defects and fill with mortar as specified herein.

1. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement. Where necessary, in the opinion of the Landscape Architect, cut out defective joints in masonry, and replace with new materials, exercising extreme care to match original work.

C. Provide polyethylene coverings or other temporary protection approved by the Landscape Architect for all lawn, planting and other non-working areas or improvements adjacent to masonry cleaning zone. Plant beds shall be further protected from foot traffic and the associated soil compaction by the placement of planking wherever foot traffic is anticipated. Remove protective coverings from lawn or planting areas immediately following completion of cleaning operations.

C. Final Cleaning: After mortar is thoroughly set and cured and before Final Completion at a time approved by the Landscape Architect, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Submit proposed cleaning procedures and cleaning materials to the Landscape Architect for approval before commencing work. Test cleaning methods on sample wall panel; leave 1/2 panel un-cleaned for comparison purposes. Obtain the Landscape Architect approval of sample cleaning before proceeding with cleaning of masonry. General cleaning shall not commence until the test area has been approved by the Landscape Architect.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. All cleaning operations shall proceed from the top down.

E. Final cleaning work shall be performed only when atmospheric temperature is above 40 degrees Fahrenheit (14 degrees Centigrade) and rising.

F. Use of wire brushes or other abrasive tools for cleaning will not be permitted.

G. New concrete masonry units; Perform final cleaning by scrubbing with stiff bristle fiber brushes and water. Rinse all surfaces thoroughly with clean water.

H. Provide suitable protective coverings for all other surfaces and materials during the final cleaning procedures, and bear full responsibility for correcting any damaged caused by these operations, to the satisfaction of the Landscape Architect.

I. Remove from the site and legally dispose of all cartons, rubbish and debris resulting from work under this Section not less often than once per week.

END OF SECTION 04 30 00
SITE MASONRY

SECTION 05 05 13: FACTORY-APPLIED COATINGS FOR METALS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install the fence work of this Section, as indicated on the Contract Documents and as specified herein.

1. Painting refurbished site benches
2. Galvanizing accessible ramp handrail

1.03 QUALITY ASSURANCE

A. Environmental Compliance: Comply with State and Local environmental regulations.

1.04 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 05 Section – SITE METAL FURNISHINGS
3. Division 32 Section – SITE IMPROVEMENTS

1.05 REFERENCES

A. The following standards shall apply to the work of this Section.

1. ASTM: American Society for Testing and Materials

A-90/A90M	Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc Alloy Coatings
A 123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Allow and High Strength Low-alloy with Improved Formability
A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A900	Standard Specification for Industrial and Commercial Swing Gates
B-6	Standard Specification for Zinc
F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

3. Massachusetts Department of Transportation (MassDOT):

Specifications	Standard Specifications for Highways and Bridges

1.06 SUBMITTALS

A. Prior to ordering the below listed materials, submit sample to Landscape Architect for approval. Sample shall be representative of designated items. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples.

B. Submit manufacturer's product data and certification for the following:

1. Primer and paint products

C. Provide manufacturer's warranties for galvanizing and paint products.

PART 2 – PRODUCTS

2.01 PAINT

A. Primer coating for shop painting of galvanized surfaces shall be an epoxy or urethane coating. Recommended Dry Film Thickness shall be as recommended by manufacturer and as approved by Landscape Architect. Acceptable products and their manufacturers shall include the following:

1. Ply-Tile 520-W-45 Epoxy Primer
Manufactured by M.A.B Industrial Coatings
Broomall, PA 19008

2. Amercoat 385
Ameron International
Alpharetta, GA 30004

3. Pitt-Guard 97-946 Series All Weather Direct-to-Rust Epoxy Coatings
PPG Architectural Finishes, Inc.
One PPG Place
Pittsburgh, PA 15272

4. Macropoxy 646 Fast Cure Epoxy
Sherwin-Williams Company
www.sherwin-williams.com

5. MC-Ferrox B
Wasser High-Tech Coatings
Kent, WA 98032

B. Finish over epoxy or urethane coating shall be an aliphatic urethane coating. Recommended Dry Film Thickness shall be as recommended by manufacturer and approved by Landscape Architect. Acceptable products and their manufacturers shall include the following:

1. Ply-Thane 890 HS Coating
Manufactured by M.A.B Industrial Coatings
Broomall, PA 19008

2. Amercoat 450HS
Ameron International
Alpharetta, GA 30004

3. Pitthane II
PPG Architectural Finishes, Inc.
One PPG Place
Pittsburgh, PA 15272

4. Acrolon 218 HS Acrylic Polyurethane
Sherwin-Williams Company

www.sherwin-williams.com

5. MC-Ferrox A
Wasser High-Tech Coatings
Kent, WA 98032

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

1. Color shall be gloss black. Contractor to furnish a 5 year warranty on the paint finish.

PART 3 – EXECUTION

3.01 METAL PREPARATION AND GALVANIZING

A. Prior to galvanizing, all specified metal items shall be cleaned (pickled) in accordance with SSPC-SP8. Cleaning shall remove all rust, scale, and coating surface must be clean, dry, undamaged and free of all loose rust, dirt, grease, or other contaminants including salt deposits. Specified metal items calling for galvanizing shall be hot-dipped galvanized after fabrication and chromated after galvanizing by dipping in a 0.15 percent chromic acid solution. Galvanizing bath shall contain 0.05 – 0.09 percent nickel. Galvanize all ferrous fasteners, clips, sleeves, anchors and accessories in contact with galvanized items. Galvanizing shall comply with ASTM A123M-97A, A153/A153M-98, ASTM A385-00 as applicable. All galvanized materials shall be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the ASTM Specification and the weight of the zinc coating in ounces per square foot. Unless otherwise indicated, all items to be galvanized shall receive a 3 mil coating of zinc.

Items to be galvanized shall be galvanized after fabrication. Where size of assembly is too large for complete unit galvanizing, these assemblies shall be galvanized prior to fabrication, in as large sections as practical and then only with the written approval of the Contracting Officer. Touch up for damaged and field welded zinc-coated surfaces, clean welds, bolted connections and abraded areas. Following galvanizing, each item shall receive surface grinding to remove lumps, sags or spikes resultant from the galvanizing process. The finished surface following grinding shall be hand smooth and without irregularities. Take care not to damage the galvanized surface coating.

3.03 PAINTING

A. Surface preparation, priming and topcoat application shall follow the paint manufacturer’s instructions for coating galvanized steel surfaces. All coatings shall be shop applied.

B. All galvanized surfaces shall then be solvent cleaned in accordance with SSPC-SP1 - “Solvent Cleaning” before being blast cleaned.

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

D. All coatings shall be applied in the shop except for field touch-up after installation.

E. All galvanized steel surfaces shall receive the 2-coat shop applied paint

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

1. Conventional spray equipment with mechanical agitators shall be used for prime coat application on bare steel and for epoxy or urethane intermediate coat on galvanized surfaces.

2. All storage, mixing, thinning, application and curing efforts, techniques and methods shall be accomplished in strict accordance with the printed material data sheets and application instructions published by the respective coating material manufacturer.
3. Surfaces shall be painted with the specified prime coat material before the end of the same work shift that they were blast cleaned and before any visible rust back occurs.
4. Applied coatings shall not have runs, sags, holidays, pinholes or discontinuities.
5. The dry film thickness shall be within the range specified in the manufacturer's printed literature for the specified coating system. Dry film thickness shall be measured in accordance with SSPC-PA 2.
6. The intermediate coat shall be of a contrasting color to the prime and top coat colors.

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

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

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

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

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

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

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

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

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

3.04 ACCEPTANCE

A. Benches will be rejected by the Landscape Architect for the following reasons:

1. Exposed surfaces do not have a smooth finish and show surface differentiation and variation. Edges show nicks, grind marks or machine marks.
2. Paint has runs, sags, hairs, defective brushing, and clogging of lines and angles.

END OF SECTION 05 05 13
FACTORY-APPLIED COATINGS FOR METAL

SECTION 05 60 00: SITE METAL FURNISHINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all shop drawings, labor, equipment, materials, incidental work, and construction methods necessary to furnish and install all site metal fabrications and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Galvanized accessible ramp handrail

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 05 Section – FACTORY-APPLIED COATINGS FOR METAL
3. Division 32 Section – REINFORCED CONCRETE PAVING

1.04 REFERENCES

A. The following standards shall apply to the work of this Section:

1. Massachusetts Department of Transportation (MassDOT):
   Specifications Standard Specifications for Highways and Bridges
2. ASTM: American Society for Testing and Materials

A36/36M	Carbon Structural Steel
A53/53M	Pipe, Steel, Black and Hot-dipped, Zinc-coated
A108	Steel Bars, Carbon cold Finished, Standard Quantity
A123/123M	Zinc (Hot-dip galvanized) Coatings on Iron and Steel Products
A153/153M	Zinc Coating (Hot-dip) on Iron and Steel Hardware
A193/193M	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
A276	Stainless Steel Bars and Shapes.
A307	Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
A312/312M	Seamless and Welded Austenitic Stainless Steel Pipes
A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
A500	Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A510	Wire rods and coarse Round Wire, Carbon Steel

3. AISI: American Iron and Steel Institute

AISI 304	Stainless Steel Alloy Designation
AISI 316	Stainless Steel Alloy Designation
AISI M1020	Merchant Quality Steel
AISI BS 1449 Part 4,	Standard Mill Surface Finished

4. AWS: American Welding Society

D1.1	Structural Welding Code – Steel
D1.6	Structural Welding Code – Stainless Steel

1.05 SUBMITTALS

A. At least 30 days prior to intended use; the Contractor shall provide the following samples and submittals to the Landscape Architect for review. Contractor shall not order materials until the Landscape Architect's review of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples. Approval of samples shall not constitute final acceptance. The Landscape Architect reserves the right to reject, on or after delivery, and material which does not meet these Specifications.

B. All submittals included herein shall follow specifications established under provisions of Division 01 Section, SUBMITTAL PROCEDURES

1. Manufacturer's Literature: Submit for approval two copies each of manufacturer's material descriptions for the following:
   a. Epoxy body putty for filling vent holes after galvanizing and before painting operation
   b. Zinc-rich primer to be used for coating bare steel surfaces left exposed at the end of the galvanizing process.

2. Constructed Sample: Fabricate and submit samples of all items fabricated under this Section, showing workmanship for welds, joints, hardware and color finishing. Samples shall be fabricated per approved Shop Drawings or approved product literature catalogue sheets. These samples may not be part of the finished work. Upon approval samples shall be the standard of quality for all site metal items fabricated under this Section.

3. Shop Drawings: Submit complete shop drawings of all miscellaneous metals work required under this Section, SITE METAL FURNISHINGS for Landscape Architect’s approval. Include plans, sections and details as required to show all materials, layout, dimensions, jointing and connections for all items required.

   Shop drawings required are as follows:
   a. Galvanized accessible ramp handrail

   Shop drawings for site metal items requiring accurate dimensional relationships to newly built or as-built construction, shall be prepared following a review and confirmation of existing conditions to remain. Provide same for existing or as-built measurements and conditions for areas scheduled to receive miscellaneous metal items by the installer.
   a. Coordinate the location of all galvanizing vent holes with the galvanizer. Show locations of all vent holes on the Shop Drawings for approval by the Landscape Architect.

C. A notarized statement of compliance with specifications shall be furnished to the Landscape Architect by the galvanizer with the initial shipment of galvanized metal items. The notarized statement shall indicate that the galvanized metal items comply with the ASTM Standard and that the dry kettle method with zinc-nickel alloy was used. Stamp a representative number of pieces of galvanized metal work. The notarized statement shall declare the day each piece was galvanized. The stamp shall indicate the ASTM Standard and the coating weight.

D. The Contractor shall submit in writing the names and addresses where all galvanizing, surface preparation, priming, intermediate coat application and finish coat application are to be performed. The Landscape Architect reserves the right to visit each shop facility to inspect the surface condition of all specified miscellaneous metal items prior to shipment and delivery to the next place of work.

1.06 QUALITY STANDARDS

A. The current issue of Standard Code of Arc and Gas Welding in Building Construction shall apply to this Division 05 Section, SITE METAL FURNISHINGS, as though written out in full. Welding shall be in accordance with the Structural Welding Code of the American Welding Society.

B. Where structural joints are made by welding, the details of all joints, techniques of welding employed, the appearance and quality of welds made, and the methods used to correct defective work shall conform to requirements of the AISC and AWS codes.

C. Welds shall be made only by welders who have previously been qualified by tests as prescribed in AWS "Standard Qualification Procedure" for the type of work required.

D. All dissimilar metals shall be insulated to prevent bimetallic interaction.

E. Workmanship and finish shall be equal to the best practice of modern shops for each item of work. Metal fabrication shall be accomplished using the highest standards of workmanship. All work shall be executed by experienced metal workers, shall conform to the requirements of the Contract Documents, and meet the following requirements.

1. Individual metal pieces shall be saw cut and carefully fitted together.
2. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves.
3. Exposed surfaces shall have a smooth finish and sharp, well defined lines and arrises.
4. Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing or shop priming.
5. All surfaces and connections of metal items shall be without visible grinding marks, surface differentiation or variation.
6. All fabricated metal items shall be fine sanded throughout to produce a high standard of surface smoothness.
7. Square and rectangular steel tubing shall have sharp 90 degree corners and edges. Metal furnishings with rounded corners and edges arriving to the Project site or having been installed on the Project site will be rejected, removed and discarded. Replacement of all metal furnishings so rejected shall be entirely at the Contractor’s expense.
8. Welding shall be continuous and shall extend for the entire length of the joints except where specifically indicated on the Contract Documents. All exposed welds shall be ground smooth.
9. Weld with uncoated wire to prevent flux deposits. If coated wire is used, all flux residue shall be thoroughly removed and bare white metal exposed, prior to galvanization, if applicable. Where overlapping surfaces are welded, seal off contact area by welding all edges around contact area.
10. All welds shall be water tight.
11. All shop connections shall be full seam welded and ground flush and smooth. Field connections bolted unless otherwise permitted as indicated in this Section, SITE METAL FURNISHINGS. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water. Deform threads to prevent loosening for all exposed connections subject to vandalism.

F. Where the work of this Section, SITE METAL FURNISHINGS, must be attached to other materials or where it must be assembled and installed in the field, Contractor shall cut, drill, punch and ream, countersink and tap, or other wise provide the required holes in the shop, unless such connections are to be welded. The sizes and locations of all such holes shall be shown on the Shop drawings.

G. Metalwork to be built in with concrete or masonry shall be of the form required for anchorage or shall be provided with suitable anchors or expansion shields.

H. All materials and workmanship under this Section, SITE METAL FURNISHINGS, shall be subject to inspection in the mill, shop or field by the Landscape Architect, or by qualified inspectors retained by the Owner. Inspection shall be without expense to the Contractor. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver and store work as specified under this Section, SITE METAL FURNISHINGS, in a manner to prevent damage to surface finishes of metal items, wracking or stress of components, and to prevent mechanical damage or damage by the elements. All stored materials and items shall be protected from weather, careless handling and vandalism.

B. Items which become rusted or damaged because of non-compliance with these conditions will be rejected and shall be replaced without additional cost to the Owner.

C. Deliver work to the site in sufficient time to avoid delay in job progress and at such times as to permit proper coordination of the various parts. The Contractor shall be responsible for scheduling the delivery of all items so as to minimize on-site storage time prior to installation.

D. Deliver bolts and other small items required for erection of work under this Section, SITE METAL FURNISHINGS, bundled with their respective items.

1.08 COORDINATION

A. The work of this Section, SITE METAL FURNISHINGS, shall be completely coordinated with the work of other Sections. Verify dimensions and work of other trades which adjoin materials of this Section, SITE METAL FURNISHINGS, before installing items specified.

B. Obtain all necessary templates and patterns required from other trades for proper execution of work of this Section, SITE METAL FURNISHINGS. Furnish to other trades items to be built into work of other Sections. Supervise installation of such built-in work.

1.09 GUARANTEE

A. The Contractor shall furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Section, SITE METAL FURNISHINGS.

B. Contractor shall pay for repairs of any damage to any part of the project caused by defects in the work of the miscellaneous metals fabricator and for any repair to the materials or equipment caused by replacement. All repairs are to be done to the satisfaction of the Landscape Architect.

PART 2 - PRODUCTS

2.01 MATERIAL REQUIREMENTS

A. Provide only new materials, free from defects impairing strength, durability or appearance and of the quality specified.

B. Standard products meeting the detailed requirements specified in this Section, SITE METAL FURNISHINGS, will be considered for approval by the Landscape Architect.

C. Furnish all supplemental parts necessary to complete each item whether or not such parts are shown or specified. Furnish all fastenings for securing the work required in this Section, FURNISHINGS, to the work of other trades. Furnish, deliver, and pay for the costs of furnishing and delivery under the work of this Section, SITE METAL FURNISHINGS. Installation of all fastening devises on the job site shall be paid for under the work of other Sections.

D. Provide fastenings of the same material, color and finish as the metal to which applied unless otherwise indicated.

2.02 METALS

A. Steel for galvanization shall be fashioned from hot-rolled mild carbon steel and shall be in conformance with the following:

1. ASTM A36/A36M requirements for flat bar stock.
2. AISI M1020 requirements for steel round bar stock.
3. Steel tubing shall be in accordance with ASTM A500 Grade B requirements. Steel sections for tubing shall be one-quarter inch wall thickness.
4. All steel sections shall be fillet welded and ground smooth prior to galvanizing to the sizes and dimensions as shown on Drawings.

B. All hardware shall conform to ASTM A307 requirements.

C. All steel shall be galvanized in accordance with the requirements of this Division 05 Section, FACTORY-APPLIED COATINGS FOR METAL, after fabrication.

PART 3 - EXECUTION

3.01 METAL FABRICATION - GENERAL

A. Take all measurements required at the work site. Check measurements, compare dimensions and other data with various trades installing adjoining work to assure proper coordination.

B. Fabricate fences, rails, posts and similar items such that when installed posts and pickets are plumb and rails follow grade

C. Do all shop drilling, shop fitting, shop cutting, shop welding, and bolting required to erect, install and fit metal work to adjoining work. Conform to AISI Code for Steel or Stainless Steel as applicable. Furnish all screws, bolts, anchors, etc., required to attach metal work securely to adjoining work.

D. Welding shall be continuous except where tack welding is specifically permitted. Tack welding will not be permitted on exposed surfaces. All exposed welds shall be ground smooth.

E. Do not enlarge unfair holes by burning and forcing, but correct by reaming.

F. Install all supports and anchors for metal work except those to be cast into concrete or built into masonry as indicated.

G. Furnish all required metal inserts, anchor slots, anchors, anchor bolts, fastenings, etc., for attachment of work of all trades to cast-in-place concrete and unit masonry, except where otherwise specified or obviously included under other Sections of the Specifications.

H. Weld with uncoated wire to prevent flux deposits. If coated wire is used, all flux residue shall be thoroughly removed and bare white metal exposed. Where overlapping surfaces are welded, seal off contact area by welding all edges around contact area.

3.03 INSTALLATION

A. All metal items fabricated under this Section, SITE METAL FURNISHINGS, shall be transported to the construction site and installed in accordance with the requirements of this Section, SITE METAL FURNISHINGS. Cost of transportation of all metal items fabricated under this Section shall be paid for under this Section.

B. Install fabricated site metal in conformance to the Contract Documents and approved Shop Drawings. Set all posts and pickets plumb. Rails shall follow grade.

C. Core drill all holes in concrete and site masonry in precise locations established in the field with fabricated site metal furnishings on hand.

D. Set posts in cored holes with non-shrink grout, recessed 0.75 inches to receive sealant. All care shall be taken to prevent cracks, chips, or scratches to the accepting materials surface during the core drilling process.

3.04 ACCEPTANCE STANDARDS

A. In accordance with the requirements for Quality Standards noted in this Section and for installation as follows, site metal furnishings will be accepted only if they meet the following requirements:

1. Handrail posts are set plumb.
2. Surfaces of site metal furnishings are free of stains, cementitious coatings, grouts and things nasty.
3. Sealant set flush with surrounding receiving surface and sheds water.

END OF SECTION 05 60 00
SITE METAL FURNISHINGS

SECTION 26 56 00: ELECTRICAL FOR EXTERIOR LIGHTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to relocate two (2) site lights as shown on Contract Drawings and repair and replace any damaged conduit and wire.

1.03 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 05 Section – SITE PREPARATION
2. Division 31 Section – EARTH MOVING

1.04 REFERENCES

A. The following standards shall apply to the work of this Section.

1. National Fire Protection Association NFPA 70 National Electrical Code.
2. Underwriters' Laboratories, Inc. - Standards for Cabinets and Boxes, Service Equipment, and Rubber Covered Wires and Cables.
3. American National Standards Institute - Standards.
4. National Electrical Manufacturing Association Standards.
5. All applicable State and local codes or ordinances and requirements of the Authority Having Jurisdiction.
6. Insulated Power Cable Engineers Association Standards.
7. American Society for Testing and Materials Standards.
8. National Fire Protection Association-Pamphlet No. 31.
9. Department of Public Safety regulations.
10. Occupational Safety and Health Regulations.
11. Institute of Electronic and Electrical Engineers Standards.
12. ANSI C-2 National Electrical Safety Code

1.05 SUBMITTALS

A. Shop drawings shall be submitted in accordance with Division 01 Section – SUBMITTALS. The shop drawings shall include catalog

numbers, c u t s , diagrams, detailed dimensioned shop drawings of equipment, wiring diagrams as required, drawings, samples as requested, and such other pertinent descriptive ratings and data as may be required by the Landscape Architect. No consideration will be given to partial lists submitted from time to time on items which are interdependent for proper operation, coordination, etc. Approval of materials will be based on manufacturer's published ratings. Any equipment, fixtures and materials listed which, in the opinion of the Landscape Architect, are not in accordance with the Specification requirements, or requirements shown on the Drawings, will be rejected and others shall be submitted. Equipment and materials which are installed by the Contractor without first having been approved by the Landscape Architect shall be removed if installed and/or removed from the work site when so instructed by the Landscape Architect. No payment will be made for unapproved equipment or material or for its installation if the Contractor is ordered to remove such equipment and material.

1.06 WARRANTY

A. The electrical system or systems, together with the component units as included in this Section of the Specifications, shall be warranted for a period of one year from the date of final acceptance thereof against defective materials and workmanship. Upon receipt of notice from the Owner or Landscape Architect of failure of any parts of the warranted equipment during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All equipment and materials furnished by the Contractor shall be new and first grade, and as approved by the Underwriters' Laboratories, Inc., and/or by other standards mentioned in these Specifications. The materials to be furnished under this Specification shall be the standard products of manufacturers regularly engaged in the production of such equipment and shall be of the latest standard design. Equipment and materials shall be of the type and quality listed below

2.02 WIRE AND CABLE

A. Wires and cables shall meet applicable requirements of NFPA 70 and UL for types of insulation, jacket, and conductor specified or indicated. Wire and cable shall be new and shall have the size, grade of insulation, voltage and manufacturer’s name permanently marked on the outer covering at regular intervals and shall be delivered in complete coils or reels with identifying size, type and insulation tags.Wire and cable shall be suitably protected from weather and damage during storage and handling, and shall be in first-class condition when installed.

B. Grounding Cable. Grounding cable installed in the raceways with circuit cables shall be single conductor, stranded, soft-drawn annealed copper, 600 volt, type THW conforming to UL 83, colored green.

2.03 CONDUIT AND CONDUIT FITTINGS

A. Rigid steel. Rigid steel conduit shall be mild hot-dipped galvanized steel piping not less than 3/4 inch size. The galvanized coating of zinc shall be of uniform thickness both inside and outside, and shall be applied to the threads of the conduit. The conduit shall be further protected by one or more of the following:

1. Electro-galvanized after hot-dipped galvanizing; and/or an alkaline cleaner bath and rinse and a chromic acid bath to form a film of zinc, chromate over all; and/or, A thin polyvinyl or a lacquer coating baked on the inside and outside of conduit.

2. Conduit protected solely by enamel, electro-galvanizing, or other processes, etc., will not be acceptable. Conduit shall also conform to the following specifications.
   a. Federal Specification WW-C-581
   b. ANSI Standard C80.1
   c. ASTM Standard A 120
   d. Underwriters' Laboratories UL 6

3. Conduit shall be as manufactured by Allied Tube and Conduit Corp., Wheatland Tube Co., Republic Steel Corp. or equal.

PART 3 – EXECUTION

3.01 GENERAL

A. All equipment, materials, etc., shall be installed in accordance with the requirements of all applicable codes, local ordinances and as shown on the Contract Drawings and/or as herein described or directed by the Landscape Architect.

3.02 CONDUIT

A. Conduits shall be run exposed as indicated on the Drawings. Exposed conduits shall be securely fastened in place on not more than 5-foot centers, and hangers, supports or fastenings shall be provided at each end of straight runs, terminating in a box or cabinet. Horizontal and vertical runs may be supported by one-hole malleable straps, clamp backs, or other approved device with suitable bolts, expansion shields, or beam clamps for mounting to building structure, or special brackets or machine screws on metal surfaces. Conduit run exterior to buildings, where run underground or in or under concrete slabs in direct contact with the earth shall be rigid steel.

3.03 CABLE

A. No conductors shall be drawn into any conduit until all work which may cause cable damage is completed. Only approved cable lubricants (such as powdered soapstone) shall be used when necessary. As far as practicable, all cable shall be continuous from origin to panel termination without running splices in intermediate pull boxes. Sufficient slack shall be left at the terminations to make proper connections. Branch circuit conductors shall be continuous from outlet to outlet and no splices shall be made except within outlets, junction boxes or pull boxes. Pull boxes shall be utilized where required.

B. All wire terminals, taps and splices shall be made secure with connectors, splicing materials and methods as hereinafter specified. All splices in handholes shall be with solderless connectors.

C. All cable terminals, taps and splices shall be made cure with solderless pressure connectors unless otherwise specified. All joints shall be wrapped with self-vulcanizing bare rubber tape and friction or plastic electrical insulating tape. Where conductors are to be connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing connector. Lacquer coating of conduits shall be removed where ground clamps are to be installed.

3.04 LIGHT FIXTURES

A. Light fixture shall be installed according to manufacturer’s recommendations. Install fixtures plumb and level.

3.05 GROUNDING

A. The conduit systems and neutral conductors of all wiring systems shall be grounded.

B. Grounding shall be provided for conduits and electrical equipment in accordance with the requirements of the National and State Electrical Codes. Where grounding conductors are to be connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing connector. Lacquer coating of conduits shall be removed where ground clamps are to be installed.

C. Non-current-carrying metal parts of electrical equipment shall be effectively bonded together and grounded permanently. The size of the system or equipment grounding conductor shall be not less than the sizes given in Tables 250-66 and 250-122 of the National Electrical Code. In no case, shall the equipment grounding conductor be a system neutral or current carrying conductor. A separate green colored ground wire shall be carried with building feeders and branch circuits for equipment grounding. The equipment ground shall be bonded together and to conduits, racks, etc.

3.06 TESTS

A. After the complete electrical system or systems installation is completed, and at such times as the Landscape Architect may direct, the Contractor shall conduct operating tests for approval. All electrical equipment shall be demonstrated to operate in accordance with the requirements of this and other Sections of the Specifications.

END OF SECTION 26 56 00
ELECTRICAL FOR EXTERIOR LIGHTING

SECTION 31 11 00: SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to prepare the site, complete, as indicated on the Contract Documents, as specified, and as follows:

1. Clearing and grubbing of existing vegetation
2. Tree protection

1.03 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section – SITE PREPARATION
2. Division 32 Section – TREE PRUNING & REMOVAL

PART 2 - PRODUCTS

2.01 TREE PROTECTION FENCE

A. Tree protection fencing shall be one of the following, at the Contractor's option.

1. Galvanized chain link fencing: Posts for fencing shall be nominal 2-1/2 inches diameter, galvanized steel posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 10 feet on center maximum. Fence fabric shall be 2-inch mesh, 11-gauge minimum.

2. Wire bound wood-roll snow fence with 3/8-inch x 1-1/2-inch wide pickets, spaced approximately 2 inches apart bound together with at least 13-gauge galvanized steel wire and with brightly painted top edge. Stakes for fencing shall be steel or wood posts. Posts shall be spaced 10 feet maximum.

3. Polypropylene barricade fencing manufactured by Ben Meadows Co., 3589 Broad Street, Atlanta, GA 30366. Stakes for fencing shall be 2-inch x 4-inch wood posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 8 feet maximum.

4 Plastic polymer safety fence, Model BX2050 Safety Grid, manufactured by The Tensar Corporation, Morrow, GA 30260, or approved equal. Color shall be high visibility orange. Stakes for fencing shall be 2-inches x 4-inches wood posts, driven a minimum of 3 feet into the ground. Posts shall be spaced 8 feet on center maximum.

5. Unless otherwise indicated, height of fencing shall be 4 feet.

PART 3 – EXECUTION

3.01 CLEARING

A. Trees, shrubs, stumps, brush, grasses, turf, herbaceous plants, downed timber, rubbish, organic matter, miscellaneous vegetation or extraneous debris not indicated on the Contract Documents or designated in the field by the Landscape Architect to remain shall be cleared. Tree removal shall be specified, performed, and paid for under the work of the Division 32 Section, TREE PRUNING & REMOVAL, of this Specification.

B. Clearing shall include the felling, cutting, and satisfactory disposal of all trees, stumps and vegetative debris produced through the clearing operations.

C. Fell trees in such a way as to not injure trees to be saved. Excavation or grading within the branch spread of trees to be saved shall be performed only under the direction of the Landscape Architect unless otherwise directed.

D. Clearing includes felling of individual trees and removal of areas of other vegetation.

E. Stumps shall be removed to their full depth. Roots 3 inches and larger shall be removed to a depth of 1 foot below finished grade. Stumps shall be legally disposed of off-site.

3.02 PROTECTION OF EXISTING TREES

A. The Contractor shall make every effort not to damage existing plant materials to remain. The Contractor is required to install protection as necessary to assure undamaged plant material and adjacent conditions.

1. See additional information on the protection of maple trees located in circular driveway designated to remain and be protected, in Division 02 Section – SITE PREPARATION AND DEMOLITION of this Specification.

B. Trees designated to remain (all that are not noted to be removed on Contract Drawings) shall be protected by the placement of a tree protection fence. The Contractor shall provide tree protection enclosure fence at the drip line of trees or as noted on Contract Drawings. All other trees noted to be protected shall have fence protecting the trunks from damage.

1. Maple trees in circular driveway designated to remain and be protected on the Contract Drawings shall have their root zone protected to the greatest extent possible. At a minimum, the Contractor shall stake the limits of the tree pits and fence the area. Trunks shall be wrapped for protection. No storage of any materials shall be allowed in their driplines. Vehicle access under the dripline will be limit to the greatest extent possible and only for what is required for the preparation, grading and placement of new pavement.

C. Place tree protection additionally at all other locations where trees and/or shrubs may be jeopardized by construction activities. Tree protection fencing shall be supported with specified stakes at maximum 5 ft. on center intervals.

D. Tree protection shall remain in place and be maintained in working condition by the Contractor until directed for removal by the Landscape Architect. All tree protection devices shall be removed from the site by the Contractor at the completion of the work.

F. Vehicles shall not be parked within the dripline or where damage may result to trees to be saved. No construction materials shall be stored beneath trees to be saved.

G. Site protection fencing shall include installation and maintenance. Installation shall be suitable to withstand the duration of the project. The Contractor shall be responsible for maintaining the site protection fence in good order and if necessary, must make any adjustments immediately to ensure site safety. The Contractor shall be responsible for maintaining a clean work site including debris, trash and vegetative material removal along the temporary fence line throughout the duration of the project.

3.03 TREE PRUNING

A. Pruning shall be specified, performed and paid for under the work of the Division 32 Section, TREE PRUNING & REMOVAL, of this Specification.

B. Trees and plants designated to be saved shall be protected during pruning operations and all subsequent construction. The Contractor shall provide the handwork necessary to complete pruning operations without damage to adjacent trees as specified, performed and paid for under the work of the Division 32 Section, TREE PRUNING & REMOVAL, of this Specification. The Contractor shall provide the means necessary to prevent scrapes and scars to trunks and branches, and such damage shall require the Contractor to be assessed as previously specified above, or to replace damaged material to the satisfaction of the Landscape Architect.

END OF SECTION 31 11 00
SITE CLEARING

SECTION 31 20 00: EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing labor, equipment, materials, incidental work, and construction methods necessary to complete the EARTH MOVING, as indicated in the Contract Documents and as specified.

B. Provide all labor, equipment, materials, incidental work, and construction methods necessary to complete the EARTH MOVING which includes, but is not necessarily limited to the following:

1. Unclassified excavation
2. Common trench excavation for piping and structures
3. Fill materials, fill and compaction
4. Trench backfill
5. Drainage and dewatering as necessary to perform work in the dry
6. Rough grading
7. Removal of surplus or unsuitable materials
8. Dust control
9. Frost protection
10. Preparation of subgrade for footings, foundations, slabs, pavements, and landscaping

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 01 Section – QUALITY CONTOL
2. Division 02 Section – SITE PREPARATION & DEMOLITION
3. Division 32 Section – REINFORCED CONCRETE PAVING
4. Division 32 Section – PLANTING SOILS

1.04 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Associated General Contractors of America, Inc. (AGC):

Manual	Manual of Accident Prevention in Construction

2. American Society for Testing and Materials (ASTM):

D 422	Particle - Size Analysis of Soils
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D 1556	Density of Soil In-Place by the Sand Cone Method
D 1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Method Effort
D 2167	Density and Unit Weight of Soil In-Place by the Rubber Balloon Method
D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D 2922	Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)
D 2937	Density of Soil In-Place by the Drive-Cylinder Method
D 3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D 4491	Test Methods for Water Permeability of Geotextiles by Permittivity
D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4751	Test Method for Determining the Apparent Opening Size of a Geotextile
D 4759	Practice for Determining the Specification Conformance of Geosynthetics

3. Massachusetts Department of Transportation (MassDOT):

Specifications	Standard Specifications for Highways and Bridges

4. American Association of State Highway and Transportation Officials (AASHTO):

T11	Material Finer than 75 um (No. 200) Sieve in Mineral Aggregates by Washing
T27	Sieve Analysis of Fine and Course Aggregates

1.05 SUBMITTALS

A. Provide submittals a minimum of 7 days prior to delivery of materials.

B. Soil Samples: A 70 pound sample of each off-site material proposed for use, and of any on-site material when so requested by the Landscape Architect or testing laboratory, shall be submitted for approval.

1. Samples shall be delivered to office the Owner’s testing laboratory, as directed.

2. Samples required in connection with compaction tests will be taken by and transported to the testing laboratory.

C. Product Data: Submit product data for the following:

1. Each type of plastic warning tape.

D. Test Reports: In addition to test reports required under the Paragraph, Quality Control Testing Requirements of Part 1, submit the following:

1. Mechanical gradation (sieve analysis) of each soil material proposed for fill and backfill from on-site materials and off-site borrow sources. Mechanical gradation shall be performed on off-site sources of fill and backfill materials using the same sieves as the materials specified. Mechanical gradation shall be performed on on-site fill and backfill materials using the same sieves or testing procedures as would be required for off-site borrow materials for which the on-site materials are proposed to replace.

2. One optimum moisture-maximum density curve for each soil material.

3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.06 QUALITY CONTROL TESTING REQUIREMENTS

A. Contractor shall select and the Landscape Architect shall approve a qualified independent geotechnical engineering testing agency to perform testing during the following phases of the construction operations. Independent geotechnical engineering testing agency shall be paid directly by the Contractor. All test results shall be available to the Landscape Architect.

1. Classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

2. Observation during excavation and replacement of existing fill under paved areas.

3. Observation of compaction of excavation subgrade and paved area subgrade.

4. Observation during placement and compaction of fills.

5. Laboratory testing and analysis of fill and bedding materials specified, as required by the Landscape Architect.

6. Observe construction and perform water content, gradation, and compaction tests at a frequency and at locations determined by the testing laboratory and approved by the Owner. The results of these tests will be submitted to the Landscape Architect, copy to the Contractor, on a timely basis so that the Contractor can take such action as is required to remedy indicated deficiencies. During the course of construction, the testing laboratory will advise the Landscape Architect in writing with copy to Contractor if, at any time, in his opinion, the work is not in substantial conformity with the Contract Documents.

7. Observation of fills following interruptions by rains or other inclement weather.

B. Contractor shall perform field in-place density tests according to ASTM D 1556, ASTM D 2167, or ASTM D 2937, as applicable. Testing laboratory shall submit test results directly to the Landscape Architect for review and acceptance.

1. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.

2. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gauges at beginning of work, on each different type of material encountered, and at intervals as directed by the Landscape Architect.

3. Footing Subgrade: At footing subgrade, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Landscape Architect.

4. Paved Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area, but in no case fewer than three tests as directed by the Landscape Architect.

5. Fills and Embankments: For each 500 cubic yards or fraction thereof per shift, perform at least one field in-place density test as directed by the Landscape Architect.

C. When subgrade, fills or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

D. Testing of soils shall be in accordance with the following:

Property	ASTM Test Method
Particle - Size Analysis	D 422
Liquid Limit	D 4318
Plasticity Index	D 4318

E. The testing laboratory's presence does not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the testing laboratory, nor any observations and testing performed by the testing laboratory shall excuse the Contractor from defects discovered in his work.

F. The Owner reserves the right to modify or waive testing laboratory services.

1.07 QUALITY ASSURANCE

A. Codes and Standards: Perform the work under this Division 31 Section, EARTH MOVING complying with requirements of authorities having jurisdiction.

B. Comply with applicable requirements of NFPA 495.

C. Pre-installation Conference: Conduct conference at Project site.

1. Before commencing the work under this Division 31 Section, EARTH MOVING, meet with representatives of the governing authorities, Owner, Landscape Architect, consultants, geotechnical engineer, independent testing agency, and other concerned entities. Review the work under this Division 31 Section, EARTH MOVING procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least three working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

D. Compliance: Comply with local safety regulations and with provisions of "Accident Prevention in Construction" published by the Associated General Contractors of America, Inc.

1.08 EXAMINATION OF EXISTING CONDITIONS

A. The Contractor shall become thoroughly familiar with the existing conditions of the site, consult records and drawings of adjacent structures and of existing utilities and their connections, and note all conditions which may influence the work of this Section, EARTH MOVING.

1. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Landscape Architect and then only after acceptable temporary utility services have been provided.

2. Provide a minimum 48-hours' notice to the Landscape Architect and receive written notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

B. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting the work under this Division 31 Section, EARTH MOVING. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

C. The Contractor may, at his own expense, conduct additional subsurface testing as required for his own information with permission from Owner.

1.09 INFORMATION NOT GUARANTEED

A. Information in the Contract Documents relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall examine them for himself during the bidding period. Compensation for unforeseen subsurface conditions shall be in accordance with the general provisions of contract, including:

1. General and Supplementary Conditions and Division 01 Specification Sections

1.10 PERMITS, CODES, AND SAFETY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of the Town and State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.

B. Comply with the provisions of the Manual for Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.

C. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Drawings.

D. Obtain all inspection certificates required and deliver to Landscape Architect.

E. The Contractor shall not close or obstruct any street, sidewalk, or passageway without written permission from authorities having jurisdiction. The Contractor shall so conduct his operations as to interfere as little as possible with the use ordinarily made of roads, driveways, or other facilities near enough to the work to be affected thereby.

F. The Contractor shall secure a DIG SAFE permit number for the project to certify notification of gas, electrical and telephone utilities. All other affected utilities shall be contacted by the Contractor who shall secure notification receipts in accordance with requirements of Massachusetts law. The phone number is 811. Contractors shall notify "Dig Safe" of contemplated excavation, demolition or explosive work in public or private ways, and utility company right-of-way or easement. This notification shall be made at least 72 hours prior to the work, but not more than sixty days before the contemplated work. Such notice shall set forth the name of the street or the route number of said way and an accurate description of the location and nature of the proposed work. The Landscape Architect requires that the notification be sent to "Dig Safe" by certified mail, with copies to the Owner. The Architect requires a copy of the signed receipt of the delivery. "Dig Safe" is required to respond to the notice within 72 hours from the time said notice is received by designating at the locus the location of pipes, mains, wires and conduits. Contractor shall not commence work until "Dig Safe" has responded as noted above. The work shall then be performed in such a manner, and with reasonable precaution taken to avoid damage to utilities under the surface in said areas of the work.

G. Contractor shall contact all utility companies whose utilities might be affected by the Work of this Section, EARTH MOVING, and notify these utility companies of contemplated excavation, demotion or explosive work in public or private ways, and utility right-of-way easement. This notification shall be made at least 72 hours prior to the work, but not more than sixty days before the contemplated work. Such notice shall set forth the name of the street or the route number of said way and an accurate description of the location and nature of the proposed work. Contractor shall secure notification receipts for submission to the Landscape Architect prior to the start of the contemplated work. Contractor shall not commence work until all utility companies have responded and provided the necessary receipts. The work shall then be performed in such a manner, and with reasonable precaution taken to avoid damage to utilities under the surface in said areas of the work.

1.11 LAYOUT AND GRADES

A. Benchmarks: The Contractor shall maintain and/or reestablish benchmarks and survey monuments necessary for the work of these Contract Documents and as shown in the Contract Documents or found to exist on the site to provide a base reference for the construction. Replace any which may become destroyed or disturbed. The Contractor shall employ and pay all costs for a registered Civil Engineer or Surveyor who is licensed within the jurisdiction of the project site to lay out all lines and grades in accordance with the Drawings and as directed by the Landscape Architect, and as necessary or required for the construction. The selection of the registered Civil Engineer or Surveyor shall be subject to the Landscape Architect's approval.

1.12 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Observe all rules and regulations governing the respective utilities in executing work under this Section, EARTH MOVING. The work shall be executed in such manner as to prevent any damage to adjacent property and any other property and existing improvements such as, but not limited to:

streets, curbs, paving, utility lines and structures, monuments, bench marks and other public and private property. Protect existing structures and foundations from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by the work under this Division 31 Section, EARTH MOVING operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at his own expense, make good such damage or injury to the satisfaction of, and without cost to the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to their original condition at the completion of operations. The Contractor shall replace, at his own cost, existing bench marks, monuments, and other reference points which are disturbed or destroyed.

C. Buried structures, utility lines, and the like, including those which project less than 18 inches above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of Project.

D. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain during operations. Do not interrupt existing utilities except when authorized in writing by authorities having jurisdiction.

E. When an active utility line is exposed during construction its location and elevation shall be plotted on the Record Drawing by the Contractor and both the Landscape Architect and the Utility Owner notified in writing.

F. Provide barricades, fences, lights, signs, and all other safety devices required for the protection of the public.

1.13 DEFINITIONS

A. Base Course: The layer placed between the subbase course and surface pavement in a paving system.

B. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

C. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

D. Embankment: Any area on the site where the Contractor is required to raise grades to proposed subgrade elevations. Embankments are placed in layers to a predetermined elevation and cross section.

E. Excavation: The removal of material encountered to subgrade elevations and the reuse of the material on site as Backfill, Fill or Ordinary Borrow material as it conforms to these specifications or disposal of materials removed.

F. Finish Grade: Final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slope between points for which finished grades are indicated or between such points and existing established grades. Spot elevations shall govern over proposed contours. No ponding of surfaces shall be allowed due to lack of improper pitches across surfaces that will not allow proper drainage to occur.

G. Rock: A sound and solid mass, layer, or ledge of mineral matter in place of such hardness and texture that it:

1. Mechanical Definition of Rock: Cannot be effectively loosened or broken down by ripping in a single pass with a late model tractor-mounted hydraulic ripper equipped with one digging point

of standard manufacturer's design adequately sized for use with and propelled by a crawler type tractor rated between 210- and 240-net flywheel horsepower, operating in low gear, or

2. Manual Definition of Rock: In areas where the use of the ripper described above is impracticable, rock defined as sound material of such hardness and texture that it cannot be loosened or broken by a 6-pound drifting pick. The drifting pick shall have a handle not less than 34 inches in length.

H. Rough grade: The top surface of subbase or base courses such as gravel, crushed stone, ordinary fill, and the like, ready to receive the final surface material application. Unless stated otherwise, all rough grades shall represent compacted material depths, as specified herein.

I. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical action of in situ rock or the deposition of unconsolidated material in which more than 35 percent by weight will pass a No. 200 sieve.

J. Surplus Materials: On-site materials not used during the course of construction.

K. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

L. Structural Backfill: The designated material as indicated in the Contract Documents to attain the proposed grades abutting or adjacent to site structures.

M. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase course, drainage fill, or topsoil materials.

O. Topsoil: The upper layer of the soil profile which is supporting the growth of vegetation as evidenced by the existence therein of numerous roots and other organic matter.

P. Unauthorized excavation: Removing materials beyond indicated subgrade elevations or dimensions without direction by the Landscape Architect. Unauthorized excavation, as well as remedial work directed by the Landscape Architect, shall be at the Contractor's expense.

Q. Unclassified excavation: Removal of materials encountered when establishing required grade elevations to the depths and extents shown on the Contract Documents. Unclassified excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions.

Q. Unsuitable Material: Material that is classified as "unsuitable" shall be material having at least one of the following properties:

1. Material with a maximum unit dry weight per cubic foot less than 90 pounds as determined by ASTM D 1557.

2. Material containing visible organic matter, topsoil, organic silt, peat, construction debris, frozen material, roots, and stumps.

3. Material which has a Liquid Limit greater than 55 when tested in accordance with ASTM D 4318.

4. Material designated in the field by the Landscape Architect or the testing laboratory.

R. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

S. Utility Trench Backfill: The area bounded by the proposed finished subgrade and the cover material over the respective pipe or conduit. This material shall conform with applicable requirements for embankment or structural backfill depending on the area or zone into which the utility is installed.

1.14 COORDINATION

A. Prior to start of the work under this Division 31 Section, EARTH MOVING the Contractor shall arrange an on-site meeting with the Landscape Architect for the purpose of establishing Contractor's schedule of operations and scheduling inspection procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Landscape Architect prior to start of the work under this Division 31 Section, EARTH MOVING operations requiring inspection and/or testing.

In the event that the Contractor does not notify the Landscape Architect prior to the start of the work under this Division 31 Section, EARTH MOVING operations and inspections and tests are not made or performed by the Owner’s testing agents, the Landscape Architect may require the Contractor to remove all the work under this Division 31 Section, EARTH MOVING performed without the necessary inspections and replaced under the required supervision, review, inspections or tests at no additional cost to the Owner.

C. The Contractor shall be responsible for obtaining test samples of soil materials proposed to be used and transporting them to the site sufficiently in advance of time planned for use of these materials for testing of materials to be completed. Use of these proposed materials by the Contractor prior to testing and approval or rejection, shall be at the Contractor's risk.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. Gradation requirements shall be determined by AASHTO T11 and T27.

1. Borrow material shall from on-site or off-site sources shall contain salt levels less than 1.0 milliohms/cm as measured by electrical conductivity (EC2) of a 1:2 soil-water suspension (Test minus sieve #4 material.). Borrow material with levels of salt in excess of this level will be considered unsuitable material and shall be removed from the site by the Contractor at no additional cost to the Owner.

2. Borrow material from on-site and off-site sources shall contain levels of heavy metals or PCB less than the current levels as designated by State and or Federal regulations.

Toxic elements include, but are not limited to, the following:
a. Arsenic
b. Boron
c. Cadmium
d. Chromium
e. Copper
f. Lead
g. Mercury
h. Molybdenum
i. Nickel
j. Selenium
k. Zinc
l. PCBs

2. Borrow material with levels of heavy metals and PCBs in excess of these levels will be considered unsuitable material and shall be removed by the Contractor from the site and disposed of legally at no additional cost to the Owner.

3. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, SW, and SP; free of rock or gravel larger than 2 in. in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

4. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, GM, SC, SM, ML, MH, CL, CH, OL, OH, and PT.

B. Backfill and Fill Materials: Satisfactory soil materials as described above. On-site material for use in compacted backfill shall be natural, inorganic, granular soil, taken from areas of excavation after stripping of topsoil and removal of unsatisfactory soil materials as described above.

1. Use only backfill materials meeting the requirements of satisfactory soil materials that are free from rocks greater than 4 inches in diameter or length that have largest dimension no greater than ¾ lift thickness, or are no greater than ½ $ft.^3$ in volume. Do not use any foreign matter, such as construction debris, trash, wood, roots, leaves, sod, organic matter, or soft clay and silt. Sound pieces of building stone, masonry, and concrete from on-site sources subject to the same size limitations as stone, may be employed in backfill. Individual pieces shall be mixed into general backfill material, leaving no voids between pieces. Backfill shall be clean, non-organic material, of non-swelling character, capable of being readily compacted to form a solid, stable embankment. Pieces of bituminous pavement shall be excluded from the backfill unless their use is expressly permitted by the Landscape Architect, in which case they shall be broken up as directed. Materials containing ice or frozen lumps shall not be employed.

2. Backfill and fill materials for use under lawns and planted areas shall be free draining materials that drain at a rate greater than or equal to one inch per hour after compaction to the specified levels.

3. Suitable Excavated Material:
   a. Free from clods, silt lumps or balls of clay.
   b. Free from stones or rock fragments over 50 pounds.
   c. Free from organics, peat, etc.

4. Frozen Material:
   a. Do not backfill with or on frozen materials.
   b. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.

5. Wet Material:
   a. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet.
   b. Do not continue backfilling until the previously placed and new materials have dried sufficiently to permit proper compaction.

C. Ordinary borrow shall conform to ASTM D2487 soil classification groups GW, GP, SW, and SP, and be well graded, natural inorganic soil, meeting the following requirements:

1. It shall be free of organic or other weak or compressible materials, of frozen materials, and of stones larger than 4 inches maximum dimension.

2. It shall be of such nature and character that it can be placed to form embankments and compacted to the specified densities in a reasonable length of time.

3. It shall be free from highly plastic clays, from all materials subject to decay, decomposition, or dissolution and from cinders or other materials which will corrode piping or other metal.

4. It shall have a maximum dry density of not less than 100 lbs. per cubic foot.

5. Material from excavation on the site may be used as ordinary fill if it meets the above requirements and is approved by the Landscape Architect.

D. Gravel borrow shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation shall conform to the following:

Sieve No.	% Passing by Weight
½" (12.5mm)	50-85
#4 (4.75mm)	40-75
#50 (300um)	8-28
#200 (75um)	0- 8

1. Maximum size of stone in gravel shall be 3 inches largest dimension.

E. Dense graded crushed stone shall consist of inert angular material derived from a stone quarry that is hard, durable stone and stone screenings, free from loam and clay, surface coatings, and plastic materials. Gradation shall conform to the following:

Sieve No.	% Passing by Weight
2" (50 mm)	100
1-1/2" (37.5 mm)	70 – 100
¾" (19.0 mm)	50 – 85
#4 (4.75 mm)	30 – 55
#50 (300 um)	8 – 24
#200 (75 um)	3 – 10

F. Processed Gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation shall conform to the following:

Sieve No.	% Passing by Weight
3" (75 mm)	100
1 ½" (37.5mm)	70 – 100
¾" (19 mm)	50 – 85
#4 (4.75um)	30 – 60
#200 (75 um)	0 – 10

G. Three-quarter inch crushed stone shall consist of inert angular material derived from a stone quarry that is hard, durable, washed stone, free of deleterious materials. Gradation shall conform to the following:

Sieve Size	% Passing by Weight
1" (25 mm)	100
¾" (19 mm)	90 – 100
½" (12.5 mm)	10 – 50
3/8" (9.5 mm)	0 – 20
#4 (4.75 mm)	0 – 5

H. Stone dust shall meet the requirements of Mass DOT Standard Specifications M2.05.0.

I. Sand borrow shall consist of clean, inert, hard, durable grains of quartz or other hard durable rock, free from loam or clay, surface coatings and deleterious materials, and conforming to Mass DOT Standard Specifications M1.04.0, Type a. The allowable amount of material passing a 75 um sieve as determined by AASHTO T11 shall not exceed 10 percent by mass. The maximum particle size for Sand Borrow shall be 6.3 mm.

2.02 USES OF MATERIALS

A. Uses of Fill Materials: Fill materials listed above shall be utilized as follows and as otherwise indicated on the Drawings, specified or directed.

1. Gravel Borrow:
   a. Subbase for bituminous concrete road and parking lot pavements.
   b. Backfill for footings and structures
   c. As shown on the Contract Documents

2. Dense Graded Crushed Stone:
   a. Base for bituminous concrete road and parking lot pavements
   b. As shown on the Contract Documents

3. Processed Gravel:
   a. Drain pipe bedding and backfill
   b. Backfill for drainage and utility structures
   c. As shown on the Contract Documents

4. Crushed Stone:
   a. Drainage layer under pavement slab
   b. Underdrain filter aggregate
   c. Structural fill for footings and structures
   d. As shown on the Contract Documents

5. Ordinary Borrow:
   a. For footings and structures
   b. For backfill of utility trenches
   c. General site fills
   d. As shown on the Contract Documents

6. Backfill and Fill Materials:
   a. For footings and structures
   b. For backfill of utility trenches
   c. General site fills
   d. As shown on the Contract Documents.

2.03 FILTER FABRIC

A. Filter fabric shall be Nonwoven, needle-punched continuous filament with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by the work under this Division 31 Section, EARTH MOVING.

B. Protect subgrade and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

3.02 GRADES AND ELEVATIONS

A. The Contract Documents indicate, in general, alignments, grade elevations and invert elevations. Establish the lines and grades in conformity with the Contract Drawings. The Landscape Architect, however, may make such adjustments in the field in grades and alignments as are found necessary in order to avoid interference with any special conditions encountered.

B. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas shall be given uniform slopes between points for which finished grades are indicated or between such points and existing established grades.

C. Establish and maintain suitable stakes over all areas to be graded as directed, specified or required. Maintain sufficient reference points at all times during construction to properly perform the contract installation.

3.3 UNCLASSIFIED EXCAVATION

A. The work of excavation shall be conducted at such locations, at such rates of progress and in such a manner as will ensure the continued progress of the work, with a minimum inconvenience to the general public.

B. All material encountered during excavation shall be unclassified excavation and shall include the removal of boulders up to 3 cubic yards, earth, rock, concrete, covered pavements, abandoned utilities, abandoned foundations and all miscellaneous materials encountered as required for excavation. Boulders and rock over 3 cubic yards shall be covered under “Rock Excavation” in this Division 31 Section, EARTH MOVING. The sequence of all excavation operations shall be such as to ensure the most efficient reuse of acceptable excavated borrow materials for particular improvement application. Acceptable materials shall be used or stockpiled for later use in backfill and subgrade preparation.

C. Excavate all materials to the elevations, dimensions and form as shown in the Contract Documents and as specified for the construction of drainage structures, utilities, lawn and site improvements necessary for the completion of the utilities and site work. Excavate to elevations indicated or required within a tolerance of plus or minus 0.10 foot and as will allow footings to rest on firm, undisturbed earth or rock, free of loose materials, and as will permit rough grades to be at indicated or specified depths. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

D. Unauthorized Excavation: Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation.

1. Any excavation which has been carried, through error, beyond specified depths or dimensions, shall be backfilled by the Contractor at his own expense with compacted gravel borrow, with concrete, or with other material as directed by the Landscape Architect.

E. Hand Excavation: In general, machine excavation will be permitted with the exception of work in the vicinity of trees to remain, existing utilities and excavation of pipe bells which will be hand work. Excavate to 6 inches below the bottom of pipe or as shown on Drawings. Excavation to final grade shall be made in such a manner as to maintain the undisturbed bearing character of the soil exposed at the excavation level.

F. Inspection: After completion of the excavation and prior to commencement of foundation footings, pavements and concrete slab construction, the excavation will be inspected by the Landscape Architect to ensure that foundation elevations have been reached.

3.4 TRENCH EXCAVATION

A. Trench Excavation: If the Contractor encounters unsuitable soils materials at the specified depths during trench excavation, he shall contact the Landscape Architect and request instructions from the Geotechnical Engineer before proceeding further.

1. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
   a. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line and to meet the inverts noted on the Drawings.

2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
   a. Clearance: 12 inches each side of pipe or conduit.

3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
   a. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
   c. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

3.5 STOCKPILING

A. Stockpiling: No excavation shall be deposited or stockpiled at any time so as to endanger portions of the new or an existing structure, either by direct pressure or indirectly by overloading banks contiguous to the operation. Stockpile soil materials away from edge of excavations. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own area for stockpiling, and for moving the material back and forth from the storage area, at no additional cost to the Owner. No excavation shall be deposited within existing tree protection zones. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water away from existing drainage structures, ponds, basins, or wetland areas. Cover stockpiles to prevent wind-blown dust. The Contractor shall provide and install all erosion control specified under the Division 01 Section, SITE PREPARATION AND DEMOLITION, and receive payment for this work under this Section, EARTH MOVING.

B. Throughout the course of the work the Contractor shall provide and maintain all erosion control systems for stockpiled materials as specified in the Division 01 Section, EROSION AND SEDIMENTATION CONTROL and paid for under the work of this Section, EARTH MOVING.

3.6 FILLING, BACKFILLING AND COMPACTION

A. Placing Fills and Compacting:

1. Preparation: All areas to be filled or backfilled shall be free of vegetation, topsoil, wet materials, unsatisfactory soil materials, obstructions, deleterious materials, construction debris, refuse, compressible or decayable materials and standing water from ground surface prior to placing fills. Do not place fill when fill materials or material below it are frozen. No fill materials containing ice or frozen lumps shall be used.
   a. Plow, furrow, till or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

2. Remove all concrete formwork, temporary shoring, bracing, and sheeting prior to inspection by Landscape Architect. If approved in writing by the Landscape Architect, leave concrete formwork, temporary shoring, bracing, or sheeting in place.

3. The Contractor shall notify the Landscape Architect when excavation is ready for formal inspection. Filling and backfilling shall not be started until conditions have been approved by the Landscape Architect.

4. At the completion of excavation and before placing any fills, proof-roll compact subgrades to the same compaction levels required for placed fills as required hereinafter. Compaction procedure shall be approved by the Landscape Architect.
   a. Notify Landscape Architect when excavations have reached required subgrade.

b. When test results determines that unforeseen unsatisfactory soil is present, stop excavation work immediately and contact the Landscape Architect to determine whether or not to continue excavation work and replace the unsatisfactory soil material with compacted backfill or fill material as directed by the Landscape Architect.

4. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

5. Reconstruct subgrade damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Landscape Architect.

6. Subgrade compaction shall be tested by the testing laboratory before proceeding further.

7. All fill is to be placed "in-the-dry", to which end dewatering may be required. Spreading and drying of each layer may also be required. Dewatering, as necessary, shall be a part of the work of this Division 31 Section, EARTH MOVING, and shall be done at no additional cost to the Owner.

8. Conversely, if the testing laboratory determines that the fill is too dry for proper compaction, water shall be added to provide the specified optimum moisture content, as necessary for proper compaction.

10. Compaction of each lift shall be as specified herein and as determined by ASTM Test, Designation D1556. Fill shall be placed in successive horizontal lifts no thicker than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Compact fill to the required density as specified in this Division 31 Section, EARTH MOVING. Maximum dry density shall be determined in accordance with ASTM D1557, Method D. The following percentages of minimum to maximum dry densities shall be achieved for fill materials or prepared subgrades.

    a. Under structures, footings, paved surfaces, drainage piping, utilities and other improvements:

	Minimum	Maximum
All fills	95%	98%
Top twelve inches of subgrades in cut	95%	98%
Fills within lawn and planting areas to within eighteen inches of finished subgrade	85%	90%

    Maximum dry density for topsoils and loam shall be determined in accordance with ASTM D698. The following percentages of minimum to maximum dry densities shall be achieved for fill materials or prepared subgrades.

    b. In lawn and plant beds:

	Minimum	Maximum
Fills within lawn and planting areas in top eighteen inches of finished grade	80%	85%

11. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

12. In the case of lawn and planting areas, compaction requirements for subgrades and fills shall be considered minimums and maximums within the density percentages called for, and any over-compaction of subgrades or fills which would be detrimental to lawn or planting objectives shall be corrected by loosening subgrades or fills through tilling or other means and re-compacting to specified compaction limits.

13. The Contractor shall notify the Landscape Architect three days in advance when the rough grades are established and ready for formal inspection. No loam shall be placed on rough grades before inspection by the Landscape Architect.

3.7 AGGREGATE BASE COURSE FOR PAVEMENTS

A. Aggregate subbase and base courses for paving and the spreading, grading, and compaction methods employed shall conform to standard requirements for usual base course of this type for first class road work, and the following:

1. MassDOT Standard Specifications Section 100

B. Compaction of aggregate base courses shall be to 95 percent of maximum density as determined by ASTM D 1557, Method D. Stone greater than two inches shall be excluded from course.

C. Width of base courses shall be greater than or equal to the width of pavement surface, if continuous lateral support is provided during rolling, and shall extend a distance of at least twice the base thickness beyond edge of the course above, if not so supported.

D. Aggregate material shall be applied in lifts less than or equal to 6 inches thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.
2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.

3. Surface irregularities which exceed 1/2 inches measured by means of a. 10 feet long straightedge shall be replaced and properly compacted.

E. Subgrade, subbase course and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel or dense graded crushed stone. Materials spilled outside pavement lines shall be removed and area repaired.

F. Portions of subgrade or of construction above which become contaminated, softened, or dislodged by passing of traffic, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification before proceeding with next operation.

3.8 BACKFILLING OF TRENCHES AND STRUCTURES

A. All requirements for description, placement, compaction and spreading of fill materials as specified in this Division 31 Section, EARTH MOVING, shall be applicable to backfilling operations for trenches and structures. If the Contractor encounters unsuitable soils materials at the specified depths during trench excavation, he shall contact the Landscape Architect and request instructions before proceeding further.

B. Backfill materials as specified in this Division 31 Section, EARTH MOVING, shall be used as bedding and backfill around drainage pipes, around structures and for other uses as shown on the Drawings.

C. Approvals Prior to Backfilling: Do not commence backfilling operations for trenches and structures until all piping and other underground utilities or structures have been installed, tested and approved, and the locations of all pipe and appurtenances have been recorded.

D. Placement in Trenches: Bedding materials as specified shall be placed to the full width of the trench as indicated on the Drawings. Place and compact bedding course on rock and other unyielding bearing surfaces. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. After a pipe is bedded, the trench shall be filled to the centerline of the pipe with additional bedding material as specified except at the joint. After the

joint is inspected, that portion shall be filled in. Material under and around the pipe shall be carefully and thoroughly compacted to the densities specified in this Division 31 Section, EARTH MOVING.

E. From the centerline of the pipe to a point 12 inches above the top of the pipe place additional bedding material as backfill by hand and compacted with mechanical tampers to not less than 95% of maximum density at optimum moisture content of the material. Above this point, backfill shall be placed by machine or by hand in layers 6 inches deep and compacted to the densities specified in this Division 31 Section, EARTH MOVING. This backfill shall be extended as shown in the Contract Documents. Backfill simultaneously on all sides of pipe or structure. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

F. Place concrete backfill in all utility trenches that pass under concrete footing or within 18 inches of footings. Place concrete to level of bottom of footings.

G. Provide four-inch thick concrete base slab support for piping or conduit less than two feet-three inches below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of four inches of concrete before backfilling or placing roadway subbase course

H. Coordinate backfilling with utilities testing.

I. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

J. Place and compact final backfill of satisfactory soil material to final subgrade.

K. Install warning tape directly above utilities, twelve inches below finished grade, except six inches below subgrade under pavements and slabs.

3.9 ROUGH GRADING

A. Rough grading shall include the shaping, trimming, rolling, and refinishing of all surfaces of the subbase and base courses, shoulders, and earth slopes in preparation for final, finish grading of pavements, loams and site improvements as shown on the Drawings. The rough grading of shoulders and sloped areas may be done by machine methods. All ruts shall be eliminated. Traffic of men and equipment across soil subgrade areas shall be prohibited following excavation to the required lines and grades.

1. Shape subbase and base courses to required crown elevations and cross-slope grades.
2. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
3. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. If, during the progress of the Work, any pipe, drain or other construction is damaged due to operations under this Contract, the Contractor shall repair all damage at no additional cost to the Owner and restore damaged areas to their original conditions.

C. Do all other cutting, filling and grading to the lines and grades indicated on the Drawings. Grade evenly to within the dimensions required for grades shown in the Contract Documents and as specified herein. No stones larger than 3 inches in largest dimension shall be placed in upper 6 inches of the subgrade. Fill shall be left in a compacted state at the end of the workday and sloped to drain.

D. Slope grades to direct water away from buildings and to prevent ponding. Rough grade to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 0.10 foot.
2. Paved Areas: Plus or minus 0.05 foot.

E. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least twelve inches wide of acceptable soil materials and compact simultaneously with each subbase course and base course layer.

F. The Contractor shall bring all areas to grades as shown in the Contract Documents and in the details. The Landscape Architect, however, may make such adjustments in grades and alignments as are found necessary to avoid special conditions encountered.

G. No rubbish of any description shall be allowed to enter fill material. Such material shall be removed from the site.

H. Wherever streets, lawns, or sidewalks or other items contained within or outside the Limit of Contract lines have been excavated in fulfilling the work required under this Contract, the Contractor shall furnish and install all materials necessary to bring finish surfaces level with the existing adjacent surfaces. All work shall be installed to match the existing conditions in accordance with the governing authority. Notify the proper authorities prior to restoring surfaces outside the Contract Limit Lines.

I. Placed fill materials that become disturbed shall be regraded and re-compacted. Fill materials that become contaminated shall be removed and replaced, as directed by the Landscape Architect.

J. Contractor shall clean the subgrade of all stones greater than two inches and all debris and rubbish. Such material shall be removed from the site, not raked to the edges and buried. Notify the Landscape Architect that the subsoil has been cleaned and request his/her attendance on site to review and approve subgrade conditions prior to spreading additional specified material over the subgrade.

3.10 REMOVAL OF SURPLUS AND UNSUITABLE MATERIALS

A. Surplus excavated or surplus off-site borrow materials not required to complete site construction and unsuitable excavated materials shall, unless directed otherwise by the Landscape Architect, become the property of the Contractor who shall remove such materials from the site and legally dispose of it at no additional cost to the Owner.

3.11 DRAINAGE AND DEWATERING

A. The Contractor shall control the grading in areas under construction on the site so that the surface of the ground will properly slope to prevent accumulation of water in excavated areas and adjacent properties. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrade, and from flooding Project site and surrounding area. The Contractor shall grade and ditch the site as necessary to direct surface runoff away from open excavations and subgrade surfaces. Positive drainage (minimum 1.0 percent slope) shall be maintained at all times.

B. Protect subgrade and foundation soils from softening and damage by rain or water accumulation.

C. Should surface, rain or ground water be encountered during the operations, the Contractor shall furnish and operate pumps or other equipment, and provide all necessary piping to keep all excavation clear of water at all times and shall be responsible for any damage to work or adjacent properties from such water. All piping exposed above surface for this use shall be properly covered to allow foot traffic and vehicles to pass without obstruction.

D. Water from trenches and excavations shall be disposed of in such a manner as will not cause injury to public health nor to public or private property, nor to existing work, nor to the work completed or in progress, nor to the surface of roads, walks, and streets, nor cause any interference with the use of the same by the public. Methods of disposal of pumped effluent shall not cause erosion or siltation.

1. Provide and install all erosion and sedimentation control as specified on the Contract Drawings and be paid for this work under the scope of this Section, EARTH MOVING.

E. There shall be sufficient pumping equipment, in good working order, available at all times to remove water.

F. Presence of ground water in soil will not constitute a condition for which an increase in the Contract price may be made. Do not place concrete fill, lay piping or install appurtenance under any circumstances in excavation containing free water.

G. Under no circumstances place fills, pour concrete, or install piping and appurtenances in excavations containing free water.

H. Where, in the opinion of the Landscape Architect, pumping of excavations is not effective in maintaining a dry firm subgrade, provide other dewatering methods acceptable to the Landscape Architect.

3.12 FROST PROTECTION

A. Do not excavate to full indicated depth when freezing temperatures may be expected, unless footings or slabs can be poured immediately after the excavation has been completed. Protect the excavation from frost if placing of concrete is delayed.

B. Completed foundations that have not been backfilled shall be protected from freezing by temporary additional earth cover, insulating blankets, heaters, or other methods acceptable to the Landscape Architect.

C. Frozen material shall not be placed as fill or backfill.

D. No work shall be installed on frozen ground.

E. Should protection fail, remove frozen materials and replace with concrete or gravel borrow as directed by the Landscape Architect at no additional cost to the Owner.

3.13 DUST CONTROL

A. During the construction period, the Contractor shall take special measures including, but not limited to, wetting down to control dust on site, in order to prevent annoyance/and or damage to adjacent property, whether public or private. Calcium chloride or any other chemical material may not be used on subgrades of areas to be seeded or planted.

B. The Contractor shall take all necessary measures to keep streets, over which equipment and service for project travel, clean and free from dirt, dust, mud and debris resulting from construction operations. The actions taken shall meet the requirements of all authorities having jurisdiction.

3.14 CLEANUP

A. At the end of all excavation, filling and grading operations and before acceptance of the work, the Contractor shall remove all debris, rubbish, garbage, trash, and discarded material, from the site. He shall dispose of them in a manner satisfactory to the Landscape Architect. The premises shall be left clean, presentable, and satisfactory.

END OF SECTION 31 20 00
EARTH MOVING

SECTION 32 01 90: TREE PRUNING & REMOVAL

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform selective pruning and related trenching within the limits indicated on the Contract Documents and as specified herein. Work shall include, but not be limited to, the following:

1. Root pruning
2. Tree removal

1.03 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American National Standards Institute (ANSI):
A300 Tree Care Operations; Tree, Shrub, and Other Woody Plan Maintenance, Standard Practices:
a. Part 1, Pruning
b. Part 2, Fertilization
c. Part 3, Support Systems a. Cabling, Bracing, and Guying
Z133.1 Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush

2. National Arborist Association, 3537 Stratford Rd., Wantagh, NY 11793 (NAA):
Ref. 1 Pruning Standards for Shade Trees
Ref. 2 Standard for Fertilizing Shade and Ornamental Trees

3. Massachusetts Food and Agriculture Department (MA):
Ref. 1 Control Recommendation Guide for Insect, Disease, and Weed Pests of Shade Trees and Woody Ornamentals

1.04 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section – SITE PREPARATION AND DEMOLITION
2. Division 31 Section – SITE CLEARING

1.05 SUBMITTALS

A. At least 90 days prior to the start of construction activities, submit to the Landscape Architect name of professional Certified Arborist hired to perform the work of this Section and proof of arborist's certification.

1.06 QUALITY ASSURANCE

A. Selective pruning methods shall conform to the applicable requirements of ANSI Z133.1.

B. Work of this Section shall be completed by a professional Certified Arborist with a minimum five years experience, who has successfully completed a certification program equal to the Massachusetts

Certified Arborist (MCA) program/examination sponsored by the Massachusetts Arborists Association, Natick, MA.

1.07 COORDINATION

A. Notify Landscape Architect before work that requires inspection or testing or both.

B. Do not perform hand trenching and/or tunneling work until required root and crown pruning is complete and Landscape Architect is present for inspection.

1.08 WARRANTY

A. Damage and Destruction of Trees shall be in accordance with the requirements of Division 31 Section, SITE CLEARING of this Specification.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 PREPARATION

A. The Contractor shall be responsible for the protection of all existing trees and plants designated to remain for the length of the construction period, including liability for all damages as specified in this Section.

3.02 ROOT PRUNING

A. Where construction will be in close proximity to existing trees designated to remain, roots shall be pruned prior to trenching and tunneling operations. Root pruning shall be performed as early as possible before trenching or tunneling operations. Proximity shall be as determined in the field by the Landscape Architect.

B. Root pruning is the physical cutting of tree roots to minimize root damage and promote healing. Root prune using a sharpened spade for all roots smaller than one-inch diameter. Root prune using an ax or chainsaw for all roots greater than one-inch diameter. Any method which tears roots or disturbs the soil beyond the grading limit is unacceptable. Do not use backhoe bucket or any other excavating machine to root prune.

C. Backfill root pruning trench with existing soil mixed with peat moss to a mixture of approximately 75 percent loam and 25 percent humus by volume. Tamp soil in 6-inch lifts. Each lift shall be compacted to a point at which a foot print makes only a 1/16 inch impression.

D. Apply mulch to a depth of 3 inches at minimum 10 ft. to 15 ft. radius around tree to reduce compaction and increase moisture retention.

3.03 TREE PRUNING

A. Trees designated to be pruned during construction shall be pruned by an approved Arborist at the direction of the Landscape Architect.

B. Any accidental injuries to the bark, trunk or branches of any tree shall be repaired immediately as directed by the Landscape Architect.

1. All pruning must be done in compliance with American National Standards Institute Z133 and A300 standards.

2. Prior to the start of work all trees to be pruned shall be inspected by an Arborist certified by the International Society of Arboriculture. Proof of certification is required prior to granting of contract. Any unusual safety or tree health concerns must be recorded and presented to the

Landscape Architect.

3. All pruning cuts shall be made according to ANSI A300 section 5.2.5. No stubs shall be left nor shall flush cuts be made, the branch collar shall be left intact. Severed limbs shall be removed before the end of the workday. Wound dressing shall not be applied.

4. Tree branches shall be removed in a manner that does not damage the tree, other plants or property. Where necessary, ropes shall be used to lower large branches. Not more than 1/4 of the leaf surface of a tree shall be removed. Upon completion of pruning, one half or the foliage shall remain evenly distributed in the lower two thirds of the tree crown and on individual limbs.

5. The following classes of pruning shall be used as designated on the Drawings:
   a. Crown cleaning: Trees designated for crown cleaning shall have dead, dying, diseased and/or weak branches one inch in diameter and larger removed. Not more than one out of 4 water sprouts shall be removed when present. One stem of weakly attached "V-crotches" less than 4 inches in diameter shall be removed. The presence of larger V-crotches shall be noted and provided to the Landscape Architect.
   b. Crown thinning: Trees designated for crown thinning shall have all branches specified in crown cleaning removed and in addition shall have 10 to 15 percent of the live branches removed, mainly from the outer crown of the tree. Preference shall be given to the removal of branches outside the normal shape of the tree crown. The majority of the live branches to be removed shall be between 1/4 and 1 inch in diameter.
   c. Crown raising: Trees may be designated for crown raising as well as one of the two other types of pruning. Crown raising shall consist of removal of lower limbs at the trunk or the removal of smaller branches that will allow the upward movement of a lower limb to provide 8 feet of clearance.

6. All appropriate safety regulations must be followed. A ground person must be situated to direct pedestrian traffic and to maintain a safe work site.

3.03 TREE REMOVAL

A. Trees designated for removal on the plans shall be removed from the site. This work shall include the felling of the trees in such a way as to not injure trees to be saved, utility lines and poles, houses, garages, lawns, plantings and pavement. Tree removal also shall include the satisfactory disposal of all tree trunks, branches, stumps and vegetative debris produced through the tree removal operation.

B. Prior to the commencement of tree removal operations the Contractor shall review with the Landscape Architect which trees shall be removed. Under no circumstances shall the tree removal operation commence without the written concurrence of the Landscape Architect.

3.04 PUBLIC HEALTH AND SAFETY

A. Upon encountering any condition of tree work or tree health which might threaten the public health, safety or welfare and which is not directly addressed by this Section the certified arborist and the Contractor shall notify the Landscape Architect immediately and shall make recommendations pertaining to the resolution of said conditions.

END OF SECTION 32 01 90
TREE PRUNING

SECTION 32 12 16: ASPHALT PAVING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install the bituminous concrete pavement, permits, traffic control and police detail, as indicated on the Contract Documents and as specified herein, and as follows:

1. New bituminous pavement
2. Sealing cracks in existing bituminous pavement to remain, as noted on Contract Drawings

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section – SITE PREPARATION
2. Division 31 Section – EARTH MOVING
3. Division 31 Section – SITE CLEARING

1.04 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Association of State Highway and Transportation Officials (AASHTO):
   M 20 Penetration Graded Asphalt Cement
   M 82 Cut-Back Asphalt (Medium Curing Type)
   M 140 Emulsified Asphalt

2. American Society for Testing and Materials (ASTM):
   D 1557 Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-pounds (4.54-kg) Rammer and 18-in. Drop

3. Massachusetts Department of Transportation (MassDOT):
   Specifications Standard Specifications for Highways and Bridges

4. Federal Specifications:
   SS-S-1401 Sealing Compound, Hot Applied, for Concrete and Asphalt Pavements

1.05 SAMPLES AND SUBMITTALS

A. At least 30 days prior to intended use, the Contractor shall provide job mix formula for all bituminous concrete specified in this Section, listing quantities and pertinent ingredient properties for review and approval by the Landscape Architect. Do not order materials until Landscape Architect's approval of mix formula has been obtained. Delivered materials shall closely match the approved samples.

1.06 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for construction of the bituminous concrete pavement shall conform to the applicable portions of the following:

1. MassDOT standard Specifications Section 400.

B. Paving work, base course installation, top coarse installation and the like, shall be done only after excavation and construction work which might damage them has been completed. Damage caused during construction shall be repaired before acceptance.

C. Pavement subbase shall not be placed on a muddy or frozen subgrade. Pavement courses shall not be placed on frozen or contaminated base course or binder course.

D. Existing pavement under state or local jurisdiction shall, if damaged during the course of this project, be repaired or replaced as specified, performed and paid for under this section of the Specification. Materials and construction shall match local or state paving standards and cross sections, whichever is most stringent.

1.07 TESTING AND INSPECTION

A. The Owner reserves the right to retain an independent testing laboratory to perform inspection and testing of paving and associated work in accordance with Division 01 Section, QUALITY CONTROL.

PART 2 – PRODUCTS

2.01 BASE COURSE

A. Material for base course shall be specified, provided, installed and paid for under the work of the Division 31 Section, EARTH MOVING, of this Specification.

2.02 SUBBASE COURSE

A Material for subbase course shall be specified, provided, installed and paid for under the work of the Division 31 Section, EARTH MOVING, of this Specification.

2.03 BITUMINOUS CONCRETE

A. Bituminous concrete shall be a standard plant-mixed, hot-laid paving material for road work, consisting of clean, crushed rock aggregate, mineral filler, and asphalt conforming to the following:

1. MassDOT Specifications Section M03.

B. Bituminous Concrete Mixtures: Bituminous concrete for roadway and parking lot pavements and patching shall be Class I, Type I-1, furnished in accordance with MassDOT Standard Specifications Section M03, except as modified herein.

1. Bituminous concrete pavement for roadways and parking lots and other areas shown on the Contract Documents shall consist of 2 courses of bituminous concrete with a minimum finished pavement depth after rolling equal to the following:
   a. Total Compacted Pavement Thickness shall be as indicated on the Contract Documents.
   b. Binder course shall consist of one lift of Binder Course bituminous concrete to thickness as shown on the Contract Documents.
   c. Finished top course shall consist of one lift of Top Course bituminous concrete to thickness as shown on the Contract Documents.

2. Bituminous concrete patch shall consist of the following:
   a. Top Course and Binder Course bituminous concrete in depths to match existing roadways.

C. Hot Mix Asphalt

1. Pavement mixtures shall be within the composition limits of base courses, binder courses, top courses and surface treatment, in accordance with MassDOT M3.11.03, with constituents that conform to table below.

Percent By Mass Passing Sieve Designation						
Standard Sieves (inches)	Reclaimed Subbase	Base Course	Binder Course	Top Course	Modified Top Course	Surface Treatment
3 inch	100%					
2 inch		100%				
1-1/2 inch	70-100					
1 inch		55-80	100%		100%	
3/4 inch	50-85		80-100		95-100	
5/8 inch				100%		
1/2 inch		40-65	55-75	95-100	79-100	
3/8 inch				80-100	68-80	100%
No. 4	30-60	20-44	28-50	50-76	46-68	80-100
No. 8		15-33	20-38	37-54	33-53	64-85
No. 16				26-40	20-40	46-68
No. 30		8-17	8-22	17-29	14-30	26-50
No. 50	8-24	4-12	5-15	10-21	9-21	13-31
No. 100				5-16	6-16	7-17
No. 200	0-100	0-4	0-5	2-7	2-6	3-8
Binder (Bitumen)		4-5	4.5-5.5	5.5-7	5-6	7-8

a. Percentages shown for aggregate sizes are stated as proportional percentages of aggregate for the mix.

2. Unless authorized by the Landscape Architect, no Job-Mix Formula will be approved which specifies:
   a. More than 45% passing No. 8 for Top and Dense Binder Courses
   b. More than 38% passing No. 8 for Modified Top Course
   c. More than 55% passing No. 8 for Dense Mix
   d. Less than 4% passing No. 200 for Top Course
   e. Less than 6% bitumen for Top Course

2.04 BITUMINOUS MATERIALS

A. Bituminous crack sealer shall be a hot-applied bituminous sealer conforming to Federal. Specification SS-S-1401.

B. Tack coat shall consist of asphalt emulsion, Type RS-1 or RS-2 conforming to MassDOT Specifications.

C. Prime coat shall be Asphalt Primer conforming to MassDOT Specifications, M03 Asphalt Primer, and in accordance with the requirements of AASHTO M116.

PART 3 – EXECUTION

3.01 GRADING

A. Areas to be paved shall be compacted and brought approximately to subgrade elevation as specified, performed and paid for under the work of Division 31 Section, EARTH MOVING, before work of this section is performed. Final fine grading, filling, and compaction of subgrade to receive paving, as required to form a firm, uniform, accurate, and unyielding subgrade at required elevations and to required lines, shall be specified, performed and paid for under the Division 31 Section, EARTH MOVING, of this Specification.

B. Existing subgrade material that will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring subgrade to required line and grade and to

replace unsuitable material removed shall be material specified, delivered, installed and paid for under the Division 31 Section, EARTH MOVING.

C. Subgrade of areas to be paved shall be re-compacted as required to bring top 8 inches (200 mm) of material immediately below gravel base course to a compaction of at least 95 percent of maximum density, as determined by ASTM D 1557, Method D. Subgrade compaction shall extend for a distance of at least 12 inches beyond pavement edge.

D. Excavation required in pavement subgrade shall be completed before fine grading and final compaction of subgrade are performed. Where excavation must be performed in completed subgrade or subbase subsequent backfill and compaction shall be performed as directed by the Landscape Architect as specified, performed and paid for under the work of the Division 31 Section, EARTH MOVING. Completed subgrade after filling such areas shall be uniformly and properly graded.

E. Areas being graded or compacted shall be kept shaped and drained during construction. Ruts greater than or equal to 2 inches deep in subgrade, shall be graded out, reshaped as required, and re-compacted before placing pavement.

F. Materials shall not be stored or stockpiled on subgrade.

G. Disposal of debris and other material excavated and/or stripped as specified, performed and paid for under the work of this section, and material unsuitable for or in excess of requirements for completing work of this section, shall conform to the following:

1. Material shall be legally disposed of off-site.

H. Prepared subgrade will be inspected by the Landscape Architect. Subgrade will be approved by the Landscape Architect before installation of paving base course. Disturbance to subgrade caused by inspection procedures shall be repaired as specified, performed and paid for under Division 31 Section, EARTH MOVING.

3.02 AGGREGATE BASE COURSE

A. Aggregate base course for bituminous paving shall be provided, installed and paid for under the Division 31 Section, EARTH MOVING.

3.03 BITUMINOUS PAVING

A. Bituminous paving mixture, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base, and related requirements shall conform to the following:

1. Road and Parking: MassDOT Specifications Section 400 - Class I Bituminous Concrete Pavement for roadway and parking areas.

2. Berm: MassDOT Specifications Section 470 Class I Bituminous Concrete Berms.

B. Bituminous binder and wearing surface courses shall each be applied individually, in single lifts of full thickness indicated on the Contract Documents.

C. No mix shall be placed on wet or damp surfaces. No mix shall be placed when ambient temperatures are 40^{O}F and falling.

D. The temperature of bituminous concrete mixture when delivered to the site shall conform to MassDOT Specifications Section 400

E. The Landscape Architect may require the Contractor to remove and replace at this own expense any defective mix not conforming to the specified job mix formula.

1. If, at any time before the final acceptance of the work, any soft, imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new materials and then compacted until the edges at which the new work connects with the old become invisible.

F. Adjacent paving and curb work shall be protected from stain and damage during entire operation. Damaged and stained areas including curbs shall be replaced or repaired to equal their original condition.

J. Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to Landscape Architect, is provided. Loads which have been wet by rain or otherwise will not be accepted. Hauling over freshly laid or rolled material will not be permitted.

K. Spreading and Finishing:

1. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to lines, grade, width and crown by means of fully automated controls for both longitudinal and transverse slope.

2. If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other permanent blemishes in the pavement, which are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and other satisfactory spreading and finishing equipment shall be provided by the Contractor.

3. The mixtures shall be placed and compacted only at such times as to permit the proper inspection and checking by the Landscape Architect.

4. The mixtures shall be placed only upon approved surfaces that are clean from foreign materials and dry; and when weather conditions are suitable.

5. The contact surfaces of curbing, manholes, catch basins or other appurtenant structures in pavement shall be painted thoroughly with a thin uniform coating of bitumen (MassDOT Specifications RS-1) just before any mixture is placed against them. This requirement shall be included as work incidental to paving operations.

6. Machine Spreading: All mixtures shall be deposited in an approved mechanical spreader and immediately spread thereby, and then struck off in a uniform layer to the full width required and of such depth that each course, when compacted, shall have the required thickness and shall conform to the grade and cross section contour specified.

7. Hand Spreading: Spreading by hand methods will be permitted only for particular locations in the work which because of irregularity, inaccessibility or other unavoidable obstacles do not allow mechanical spreading and finishing.

L. Placing and rolling of mixture shall be as nearly continuous as possible. Rolling shall begin as soon after placing as mixture will bear the operation without undue displacement. Delays in rolling freshly spread mixture will not be permitted. Rolling shall proceed longitudinally, starting at edge of newly placed material and proceeding toward previously rolled areas. Rolling overlap on successive strips shall be greater than or equal to 1/2 width of roller rear wheel. Alternate trips of roller shall be of slightly different lengths. Corrections required in surface shall be made by removing or adding materials before rolling is completed. Skin patching of areas where rolling has been completed will not be permitted. Course shall be subjected to diagonal rolling, crossing lines of the first rolling while mixture is hot and in compactable condition. Displacement of mixture or other fault shall be corrected at once by use of rakes and application of fresh mixture or removal of mixture, as required. Rolling of each course shall be continued until roller marks are eliminated. Roller shall pass over unprotected edge of course only when paving is to be discontinued for sufficient time to permit mixture to become cold.

M. In places not accessible to roller, mixture shall be compacted with hand tampers. Hand tampers shall weigh at least 50 pounds and shall have a tamping face less than or equal to 100 square inches. Mechanical tampers capable of equal compaction will be acceptable in areas in which they can be employed effectively.

N. Edges of bituminous concrete that meet turf areas shall be shaped to provide a neat, clean edge and shall be hand tamped.

O. Compaction:

1. After the paving mixture has been properly spread, compaction shall be obtained by the use of power rollers of approved design and weight per inch (millimeter) of roller. The rollers shall be steel wheeled supplemented with pneumatic-tired rollers where required.

2. Along curbs, structures and all places not accessible with a roller, the mixture shall be thoroughly compacted with mechanical tamping devices. The surface of the mixture after compaction shall be smooth and true to the established line and grade.

3. The densities of the completed pavement shall be not less than 95 percent of the density obtained from laboratory compaction of a mixture composed of the same materials in like proportions.

P. Portions of pavement courses which become mixed with foreign material or are in any way defective shall be removed, replaced with fresh mixture, and compacted to density of surrounding areas. Bituminous material spilled outside lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.

Q. Joints shall present same texture, density, and smoothness as other sections of the course. Continuous bond shall be obtained between portions of existing and new pavements and between successive placements of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and subgrade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.

R. Contact surfaces of previously constructed pavement (if greater than or equal to two days since binder placed), manholes, and similar structures shall be thoroughly cleaned and painted with a thin uniform coating of bitumen immediately before fresh mixture is placed. Tack coat shall be applied at rate which will leave bituminous residue of 5 to 7 gallons/100 $yd.^2$ after evaporation of vehicle. Base surface shall be dry and clean when tack coat is applied. Bituminous paving material shall not be placed until vehicle has completely evaporated from tack coat. Adjoining new paving shall be placed before tack coat has dried or dusted over.

S. Earth or other approved material shall be placed along pavement edges in such quantity as will compact to thickness of course being constructed, allowing at least 12 inches of shoulder width to be rolled and compacted simultaneously with rolling and compacting surface. Pavement edge shall be trimmed neatly to line before placing earth or other approved material along edge.

T. Variations in pitch of finished surface shall be less than or equal to the following tolerances when tested with a 10-foot straightedge, applied both parallel to and at right angles to centerline of paved area.

1. At joint with existing pavement, and at other locations where an essentially flush transition is required, pavement elevation tolerance shall not exceed 0.01 feet.

2. At other areas pavement elevation tolerance shall not exceed $\pm$ 0.05 feet.

3. Irregularities exceeding these amounts or which retain water on surface shall be corrected by removing defective work and replacing with new material as specified, performed and paid for under this section.

U. No vehicular traffic of any kind shall be allowed to pass over the newly finished surface until it has had time to set. Seventy-two hours will be considered sufficient time for the pavement to set in most cases, but this period may be extended by the Landscape Architect as required by weather or other reasons. Under all circumstances, damage to the pavement caused by the Contractor's or public vehicles driving over the pavement before the pavement has fully cured shall be repaired as specified, performed and paid for under this section, at no additional cost to the Owner.

END OF SECTION 31 12 16
ASPHALT PAVING

SECTION 32 13 13: REINFORCED CONCRETE PAVING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install CONCRETE PAVING, as indicated on the Contract Documents and as specified herein.

1.03 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Concrete Institute (ACI):
   - 306R Cold Weather Concreting
   - 316R Recommendations for Construction of Concrete Pavements and Concrete Bases

2. American Society for Testing and Materials (ASTM):
   - A 185 Specification for Steel Welded Wire Fabric. Plain, for Concrete Reinforcement
   - A 615 Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
   - C 33 Specifications for Concrete Aggregates
   - C 94 Specifications for Ready-Mixed Concrete
   - C 143 Test Method for Slump of Hydraulic Cement Concrete
   - C 150 Specification for Portland Cement
   - C 171 Specification for Sheet Materials for Curing Concrete
   - C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
   - C 309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   - C 494 Specification for Chemical Admixtures for Concrete
   - C 1116 Standard Specification for Fiber Reinforced Concrete & Shotcrete
   - D 226 Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
   - D 545 Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Non-extruding and Resilient Types)
   - D 1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)]
   - D 1752 Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

3. Massachusetts Department of Transportation (MassDOT):
   - Specifications Standard Specifications for Highways and Bridges

1.04 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 02 Section – SITE PREPARATION & DEMOLITION
2. Division 03 Section – CAST-IN-PLACE CONCRETE
3. Division 05 Section – SITE METAL FURNISHINGS
4. Division 07 Section – CONCRETE PAVEMENT JOINT SEALANTS
5. Division 31 Section – EARTH MOVING
6. Division 32 Section – SITE IMPROVEMENTS

1.05 SUBMITTALS

A. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.

B. Submit manufacturer's product data for the following:

1. Form release agent
2. Prefabricated control joint
3. Preformed joint filler
4. Sealants
5. Curing materials

C. Submit samples of the following:

1. Prefabricated control joint
2. Preformed joint filler
3. Color chart for selection of sealant color

D. Construct Concrete Sample Panels:

1. Construct 6-foot x 6-foot sample panels of finished concrete pavement for approval, at least 15 days prior to final concrete paving work. Samples shall not be constructed in an area of proposed finish work. Samples shall be constructed within the vicinity of the proposed finish work to facilitate comparisons during construction. The samples shall demonstrate the typical installation of concrete, including score lines, expansion joint and sealant, curing and finishing material, surface texture, color, and edge treatment. The accepted sample, upon approval, shall be maintained as the standard of minimal quality for approval of all proposed concrete pavement work required for the project. If the original sample panel is not approved, the Contractor shall provide additional sample panels, as required, at no additional cost to the Owner until an approved sample is obtained. Unacceptable sample panels shall immediately be removed from the site.

E. Test reports for concrete, per paragraph 1.6A

1.06 QUALITY ASSURANCE

A. Unless otherwise specified, work and materials for construction of the reinforced Portland cement concrete paving shall conform to ACI 316R, and applicable portions of the following:

1. MassDOT Specifications Section 400 Cement Concrete Pavement.

B. Surfaces of curb ramps and handicapped access ramps shall be stable, firm and slip resistant. Construct ramps so that water does not accumulate on ramp surfaces.

C. Paving work, base course installation, top course installation, and the like, shall be done only after excavation and construction work which might injure them have been completed. Damage caused during construction shall be repaired before acceptance.

D. Existing paving areas shall, if damaged or removed during course of this project, be repaired or replaced under this Division 32 Section, REINFORCED CONCRETE PAVING. Workmanship and materials for such repair and replacement, except as otherwise noted, shall match as closely as possible those employed in existing work installed under this Contract.

E. Pavement, base, or subbase shall not be placed on a muddy or frozen subgrade.

1.07 TESTING AND INSPECTION

A. The Contractor shall perform slump and compressive strength tests for concrete paving. Slump tests shall be performed on every truck delivery. Compressive strength tests shall be performed every 50 cubic yards delivered. Compressive strength testing shall include three cylinder per test (one each for 7 day, 28 day and a reserve). All tests shall be paid by the Contractor.

PART 2 – PRODUCTS

2.01 AGGREGATE BASE COURSE

A. Base course shall be existing aggregate base re-graded and compacted. Existing base shall be supplemented with similar materials as requires to meet the proposed elevations.

2.02 STEEL REINFORCEMENT

A. Welded wire fabric (WWF) reinforcement shall conform to the applicable requirements of ASTM A 185. Fabric reinforcement shall be furnished in flat sheets. Fabric reinforcement in rolls will not be permitted.

1. Provide 6 inches x 6 inches W2.9 x W2.9 WWM for 6 inch thick concrete pavement, 6 inches x 6 inches W3.4 x W3.4 WWM for 8 inches thick concrete pavement and 6 inches x 6 inches W1.4 x W1.4 WWM for 4 inches concrete pavement.

B. Steel reinforcing bars shall conform to ASTM A 615.

1. Bars employed as reinforcement shall be deformed type.
2. Unless otherwise indicated on the Contract Documents, reinforcing bars shall be Grade 60.

C. Steel expansion dowels shall be hot-rolled plain steel rounds conforming to the requirements of AASHTO M31, Grade 60 and consisting of a 1/2 inches by 24 inches smooth steel dowel and compatible waxed tube sleeve, by 12 inches in length.

1. Dowels and sleeves shall be as furnished by A.H. Harris & Sons, Inc., by U.S. Steel Corp., by Edgecombe Steel Corp., or approved equal.
2. Dowels shall be epoxy coated.

2.03 PORTLAND CEMENT CONCRETE

A. Cast-in-place concrete shall be air-entrained concrete with minimum 28-day compressive strength of 4,000 pounds per square inch (30 MPa), conforming to the requirements and applicable provisions of MassDOT Specifications Section M02.

1. Air Entrainment: Concrete shall be air-entrained 7 percent minimum +/-1 percent, by volume.
2. Slump: Concrete shall have a slump of 2 inches to 4 inches slump.
3. Maximum Aggregate Size: Aggregate size shall be a maximum of 3/4 inches.
4. Thickness of Concrete: Depths shall be as noted on the Contract Documents.

2.04 CURING MATERIALS FOR PLAIN CONCRETE

A. Curing shall be by moist curing or by use of curing compound.

B. Curing paper shall be non-staining, fiber reinforced laminated kraft bituminous product conforming to ASTM C 171. Four mil polyethylene sheeting may be substituted for curing paper.

C. Curing compound shall be a resin-base, white pigmented compound conforming to ASTM C 309, Type 2.

2.05 EXPANSION JOINTS

A. Provide expansion joints as indicated and in accordance with the following:

1. Unless otherwise indicated on the Contract Documents, expansion joints shall be located 20 feet on center, maximum.
2. Location of expansion joints are indicated on the Contract Documents.

B. Expansion Joint Filler:

1. Closed cell polymer foam meeting requirements of ASTM D 1752, Sections 3.1 to 3.4, based on compression requirement of 10 pounds per square inch minimum and 25 pounds per square inch maximum. Recovery rate following 50 percent compression shall exceed 99 percent recovery, per ASTM D 545. Foam shall be equal to Ceramar Foam Filler, manufactured by W.R. Meadows. Inc., or an approved equal.

2. Expansion joint filler shall have a removable cap cover for the joint filler with integral permanent plastic bond breaker such as Snap-Cap from Seal Tight manufactured by W.R. Meadows, Inc., or approved equal. Cover width shall be sized to match width of joint filler.

2.06 CONTROL JOINTS

A. Control joints in concrete shall be made using a preformed contraction joint equal to the Plastic Contraction Joint distributed by A.H. Harris & Sons, Inc., Medfield, MA 02052, or approved equal.

1. Preformed contraction joint shall be specifically designed to form construction and weaken plane joints.

2. Dimension of prefabricated joint former shall be as indicated on the Contract Documents.

3. Joints shall be placed 5 feet zero inches on center, maximum or as shown on the Contract Drawings.

2.07 CONSTRUCTION JOINTS

A. Transverse construction joints shall be placed whenever placing of concrete is suspended for more than 30 minutes.

1. Butt joint with dowels or thickened edge joint shall be used if construction joints occurs at location of control joint. Submit sketch to Landscape Architect for review and acceptance of proposed system.

2. Keyed joints with tie bars shall be used if the joint occurs at any other location.

2.08 SEALANT

A. Joint sealant and primer shall be polyurethane-based, one component, elastomeric sealants, complying with Fed. Spec. TT-S-00230C, Class A Type 1. Color shall be as selected by the Owner. Sealants shall be self-leveling pour grade type.

1. Vulkem 45, as manufactured by Mameko International, 4475 East 175th Street, Cleveland Ohio 44182, (800) 321-6412.

2. Urexpan NR-210, as manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 10348, (215) 723-6051

3. PSI 951, as manufactured by Polymeric Systems Inc., Phoenixville, PA, (800) 228-5548.

B. Provide only materials which are known to be fully compatible with the actual installation condition, as shown by the manufacturer’s published data or certification. Use manufacturer’s recommended joint primer.

PART 3 – EXECUTION

3.01 PREPARATION OF SUBGRADE

A. Subgrade of areas to be paved shall be re-compacted as required to bring top 8 inches of material immediately below aggregate base course to a compaction at optimum moisture of at least 95 percent of maximum density, as determined by ASTM D 1557. Subgrade compaction shall extend for a distance of at least 12 inches beyond pavement edge.

3.02 FORMWORK

A. All forms shall be joined neatly and tightly, shall be set true to line and grade, well staked and braced, and shall have uniform bearing throughout their length. Remove all forms and miscellaneous appurtenances from pavement edges and dispose of all formwork and appurtenances at the end of the construction project.

1. Forms shall not be moved for 72 hours after the concrete has been placed, or for a longer period if directed by the Landscape Architect.

2. Remove all forms. Extreme care shall be taken in removing forms in order that no damage will be done to the concrete.

3. Under no condition shall any bar, pick or other tool be used which depends upon leverage on the concrete for removal of the forms.

3.03 STEEL REINFORCEMENT

A. Before being placed in position, reinforcing for reinforced concrete shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material which may reduce the bond between the concrete and reinforcing. Where there is delay in placing concrete after reinforcement is in place, bars shall be re-inspected and cleaned when necessary.

B. Welded Wire Mesh: Wire mesh used for reinforcement shall be spread flat before placing concrete. Mesh reinforcement shall be held firmly in place against vertical or transverse movement by means of satisfactory devices. Where mesh reinforcement is spliced, it shall be lapped at least 12 inches.

1. Unless designated otherwise on the Contract Documents, wire mesh shall be placed midway within the depth, and parallel to the finished surface of concrete pavements.

2. Do not pour concrete over top of reinforcement unless it is supported underneath.

3. Contractor shall pull reinforcement up immediately after pouring concrete to make sure that the reinforcement is in the middle of the slab and not sitting on the bottom.

C. Reinforcing Steel: After forms have been coated with form release agent, but before concrete is placed, reinforcing steel anchors shall be securely wired in the exact position called for, and shall be maintained in that position until concrete is placed and compacted.

1. Any bar showing cracks after bending shall be discarded.

2. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Landscape Architect.

D. Unless otherwise indicated on the Contract Documents, reinforcing shall extend within 2 inches of formwork and expansion joints.

1. Reinforcing shall continue through control joints.

E. The Owner may do core testing to make sure that reinforcement is in the proper position. If testing shows otherwise concrete will be rejected and the Contractor shall remove all rejected slabs and re-pour new slabs at no additional cost. Contractor shall repair cored holes as directed by the Landscape Architect.

3.04 EXPANSION JOINTS

A. Expansion joints shall be one-half inch wide and shall be as located on the Contract Documents. Expansion joint shall be formed in the concrete to required width with preformed joint filler in place. Joint filler shall extend the full depth of the slab. Joint filler shall extend the full length of the expansion joint.

1. For concrete banding and concrete pavements and pads, depth of joint filler shall be as required to form a three-quarter inch deep sealant recess below finished concrete surface.

B. Place expansion joints spaced on 20-foot centers. When provided, clarification documents that show specific locations of expansion joints shall direct the Contractor where to place expansion joints. Such clarification documents may place joints closer than 20-foot centers. In the absence of clarification documents the language of this Division 32 Section, REINFORCED CONCRETE PAVING, shall govern.

1. Expansion joints shall be placed where pavement meets flush foundations and footings, concrete or bituminous concrete curbing or other vertical structures, including light bases, hydrants, walls, buildings, piers and walls, and at other conditions as shown on the Contract Documents.
2. Contractor shall request the presence of the Landscape Architect to review the layout of expansion joints prior to pouring the concrete.
3. Follow the manufacturer's application recommendations for joint filler and sealer.
4. Joint alignment shall be straight and true.

C. Where expansion dowels are use in the expansion joints, dowels and greased sleeves shall be set parallel with the top and bottom surfaces of the concrete slab.

3.05 PORTLAND CEMENT CONCRETE PAVING

A. Paving mix, equipment, methods of mixing and placing, and precautions to be observed as to weather, condition of base and the like, shall meet the requirements of ACI 316R. Pavement shall be constructed in accordance with the Contract Documents.

B. The Landscape Architect shall be notified of concrete placement sufficiently in advance of start of operation to allow his representative to complete preliminary inspection of the work, including subgrade, forms, and reinforcing steel, if used.

1. No concrete shall be deposited until the Landscape Architect has inspected the placing of reinforcement and given permission to place concrete.

C. Normal concrete placement procedures shall be followed. Concrete shall arrive at the job site so that no additional water will be required to produce the desired slump. When conditions develop that required addition of water to produce the desired slump, permission of the Landscape Architect must be obtained. The concrete shall be transported from the mixer to its place of deposit by a method that will prevent segregation or loss of material.

1. Concrete pavement shall be placed in a series of alternate pours such that every other panel bounded by expansion joints shall be poured first.
2. The intervening panels shall then be poured as a secondary operation only after the first panels have hardened sufficiently to allow the removal of all temporary transverse forming supports.
3. Concrete shall be placed in one course, to full depth, as detailed on the Contract Documents.

D. Work shall not be performed during rainy weather or when temperature is less than 40° Fahrenheit. In the event that unforeseen rain occurs, cover all broom finished concrete surfaces with plastic sheet covering to prevent alteration of texture. Concrete slabs with textured concrete surfaces altered by rain shall be removed from the site as directed by the Landscape Architect.

E. Adjacent work shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original conditions.

F. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall thoroughly damp when concrete is placed. There shall be no free water on surface.

G. Concrete which has set or partially set before placing shall not be employed. Re-tempering of concrete will not be permitted.

H. Concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

I. When joining fresh concrete to concrete which has attained full set, latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Laitance is the accumulation of fine particles on the surface of freshly poured concrete caused by an upward

movement of water through the concrete. This can be caused by too much mixing water, by excessive tamping, or by vibration of the concrete. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately one-eighth inch thick, shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.06 FINISHING

A. Concrete flatwork surfaces shall be screeded off and hand floated and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.

1. Finished concrete surface for subbases for unit pavement systems shall be wood-floated to a slightly rough surface. Surface shall not deviate more than one-quarter inch in 10 feet.
2. Finished concrete surface for concrete walks, pads, and concrete bands shall be wood-floated and steel troweled to a smooth surface. Surface shall not deviate more than one-eighth inch in 10 feet.

B. Unless otherwise indicated, horizontal surfaces of concrete pavement which will be exposed shall be given a light broomed finish, with direction of grooves in concrete surface perpendicular to length of concrete sidewalks, landings, and pads. After concrete has set sufficiently to prevent coarse aggregate from being torn from surface, but before it has completely set, brooms shall be drawn across it to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by brooming operation.

C. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

D. Immediately following finishing operations, arrises at edges and both sides of expansion joints shall be rounded to one-quarter inch radius.

E. Control Joints:

1. Control joints shall be tooled with scored joints made by scoring into slab surface with scoring tool.
2. Control joints shall be saw cut joints as specified below.

F. All scoring, tooling and finishing of the concrete shall be subject to the review and approval of the Landscape Architect at any time during the construction project. The Contractor shall remove and replace, at no additional cost to the Owner, all concrete which is not acceptable to the Landscape Architect.

G. Where finishing is performed before end of curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.07 CURING

A. It is essential that concrete be kept continuously damp from time of placement until end of specified curing period. It is equally essential that water not be added to surface during floating and troweling operations, and not earlier than 24 hours after concrete placement. Between finishing operations surface shall be protected from rapid drying by a covering of waterproofing paper. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of a fog spray of water, applied as often as necessary to prevent drying, but not sooner than 24 hours after placing concrete. None of the water so applied shall be troweled or floated into surface.

B. Concrete surfaces shall be cured by completely covering with curing paper or application of a curing compound.

1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period surface shall be checked

frequently, and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.

2. If concrete is cured with a curing compound, compound shall be applied at a rate of 200 square feet per gallon, in two applications perpendicular to each other.
3. Curing period shall be seven days minimum.

3.08 CONTROL JOINTS

A. Unless otherwise indicated, control joints shall be tooled into the concrete slab, with 3 inches wide border and troweled edges, in pattern indicated on the Contract Documents, or every 5 feet on center maximum. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before slab has achieved its final set.

1. Scoring shall cut into slab surface at least 1 inches, but in no case not less than 25 percent of slab depth.

3.09 COLD WEATHER CONCRETING

A. Materials for concrete shall be heated when concrete is mixed, placed, or cured when the mean daily temperature is below 40 degree Fahrenheit or is expected to fall to below 40 degree Fahrenheit within 72 hours, and the concrete after placing shall be protected by covering, heat, or both.

B. Details of handling and protecting of concrete during freezing weather shall be subject to the approval and direction of the Landscape Architect. Procedures shall be in accordance with provisions of ACI 306R.

3.10 HOT WEATHER CONCRETING

A. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placing shall be sprinkled with cold water. Every effort shall be made to minimize delays which will result in excessive mixing of the concrete after arrival on the job.

B. During periods of excessively hot weather (95 degree Fahrenheit., or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305. Any concrete with a temperature above 95 degree Fahrenheit, when ready for placement will not be acceptable, and will be rejected.

C. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, and the like.) and relative humidity. Records shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the work so that conditions surrounding the construction of any part of the structure can be ascertained.

3.11 PROTECTION OF CONCRETE SURFACES

A. Concrete surfaces shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary one-half inch, thick plywood sheets shall be used to protect the exposed surface.

B. The Contractor shall provide adequate surveillance for all poured-in-place concrete pavements until concrete has set firmly, to prevent unwarranted markings of the concrete surface. Any unauthorized marking or graffiti in the finished surfaces shall be a cause for rejection by the Landscape Architect and replacement by the Contractor.

3.12 ACCEPTANCE STANDARDS

A. The following acceptance standards shall be applied to this Contract. These standards are considered superior to typical industry standards. Any portion of the concrete paving that does not come up to these required acceptance standards shall be removed at the direction of the Landscape Architect. Saw cut pavement at nearest adjacent tooled joint, remove concrete pavement and discard off site in a legal manner and replace with new concrete pavement meeting the requirements of this Section, Concrete Paving.

1. Pavement surfaces shall be free of all cracking.
2. Pavement surfaces shall not pond water.
3. Pavement surfaces shall be free of visible high and low spots.
4. Steel mesh reinforcing shall not penetrate the surfaces or sides of the concrete slab.
5. Tooled joints and all expansion joints shall be straight, true, uniform in width and free from twists, bends, kinks and misalignments.
6. Saw cut joints shall be free of chips and spauling at joint edges.
7. Tooled edges and the associated edging patterns shall be consistent, true, crisp and complete.
8. Broom finish shall not be too coarse in the opinion of the Landscape Architect.
9. Broom finish shall be constant and complete between joints without bare spots, lifts or disconnections in broom pattern.
10. Pavement shall show no graffiti. Pavement shall show no rubbed surfaces indicative of attempts to erase graffiti.
11. Expansion joints and score joints shall be placed as required by the Contract Documents.
12. Concrete surfaces shall be free of all stains, including those created during the course of the construction by the Contractor, caused by natural events, or caused by vandalism.
13. All tooled joints and expansion joints shall be flush.
14. Stains from construction or from natural causes
15. Pours different in color as determined by the Landscape Architect.
16. Pours without expansion joints cast into them.
17. Pours not conforming to the Contract Documents.
18. All forms shall be removed from the site.

END OF SECTION 32 13 13
CONCRETE PAVING

Section 32 14 16: BRICK UNIT PAVERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install the brick pavers, as indicated on the Contract Documents and as specified.

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTHWORK
2. Division 32 Section – REINFORCED CONCRETE PAVEMENT

1.04 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Association of State Highway and Transportation Officials (AASHTO):

Specifications	Standard Specifications for Highway Bridges
M 208	Cationic Emulsified Asphalt
M 140	Emulsified Asphalt

2. American Society for Testing and Materials (ASTM):

C 67	Test Methods of Sampling and Testing Brick and Structural Clay Tile
C 91	Specifications for Masonry Cement
C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
C 144	Specification for Aggregate for Masonry Mortar
C 150	Specification for Portland Cement
C 207	Specification for Hydrated Lime for Masonry Purposes
C 902	Specification for Pedestrian and Light Traffic Paving Brick
D 36	Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
D 113	Test Method for Ductility of Bituminous Materials
D 3381	Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

3. Massachusetts Department of Transportation (MassDOT):
Specifications Standard Specifications for Highways and Bridges

1.05 SUBMITTALS

A. Samples: Approval of samples shall not constitute final acceptance. The Landscape Architect reserves the right to reject, on or after delivery, any material which does not meet these Specifications.

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following items:
1. Polymeric sand joint filler
2. Neoprene-modified asphalt adhesive

1.06 SAMPLE PANEL

A. Construct a sample panel of brick pavers on the specified base, bituminous setting bed and edging before start of any brick paving. Sample panel shall exhibit proposed color range, texture, bond, expansion jointing, pattern, finish, paver size, and workmanship. Size of panel shall be 6 feet x 6 feet, minimum.

B. Sample panel shall be inspected by the Landscape Architect. If the sample is not acceptable, construct additional panels at no cost to the Owner until an acceptable panel is constructed. The sample panel upon approval shall be maintained as the standard of minimal quality for approval of all proposed brick pavement work required for the project. Sample panel shall be located near the pavement work to facilitate comparison. Remove sample panel from the site at completion of project, unless otherwise directed by the Landscape Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Brick pavers and associated installation materials shall be delivered to the job adequately protected from damage during transit.

1. Brick pavers shall be carefully packed by the supplier for shipment.
2. Pavers shall be stored off the ground and protected against staining and other damage.
3. Pavers damaged in any manner will be rejected and replaced with new materials at no additional cost to the Owner.

1.08 PROTECTION OF ADJACENT SURFACES

A. Finished surfaces adjacent to the brick paving shall be adequately protected from soiling, staining, and other damage during construction.

PART 2 – PRODUCTS

2.01 BRICK PAVERS

A. Brick pavers shall be reused from on-site stockpiles. Brick pavers with chips, cracks, stains, or other defects that might be visible in the finished work shall not be used.

1. Any binder, mortar, mastic, or other debris or stains shall be removed and cleaned from the bricks prior to their installation.

2. The Landscape Architect has to right to reject any of the brick if not sufficiently cleaned or whole.

B. Brick shall be uniform in color, size, appearance, and dimensions, and shall have smooth regular edges where they are closely butted.

2.02 BITUMINOUS SETTING BED

A. Asphalt cement to be used in the bituminous setting bed shall conform to ASTM D 3381. Viscosity grade shall be A.C. 10 or A.C. 20.

B. Fine aggregate to be used in the bituminous setting bed shall be clean, hard sand with durable particles and free from adherent coating, lumps of clay, alkali salts, and organic matter. Aggregate shall be uniformly graded from "coarse" to "fine" with 100 percent by weight passing the No. 4 sieve and shall meet the gradation requirements when tested in accordance with ASTM C 136.

C. Fine aggregate shall be dried and shall be combined with hot asphalt cement, and the mix shall be heated to approximately 300 degrees Fahrenheit at an asphalt plant. The approximate proportion of materials shall be 7 percent cement asphalt and 93 percent fine aggregate. Each ton of material shall be apportioned by weight in the approximate ratio of 145 pounds asphalt to 1,855 pounds sand. The Contractor shall determine the exact proportions to produce the best possible mixture for construction of the bituminous setting bed to meet specified requirements.

2.03 NEOPRENE-MODIFIED ASPHALT ADHESIVE

A. Neoprene modified asphalt adhesive shall meet the following requirements:

1. Mastic (asphalt adhesive):
   a. Solids (base) content by volume = 75± 1 percent.
   b. Weight = 8.0 to 8.5 pounds/gallon (1.05 to 0.97 kg./liter).
   c. Solvent vehicle = Varsol (over 100 degrees Fahrenheit flash)

2. Base (2 percent neoprene, 10 percent fibers, 88 percent asphalt):
   a. Melting point (ASTM D 36) = 200 degrees Fahrenheit minimum.
   b. Penetration at 77 degrees Fahrenheit 100 gram load 5 second (0.1 mm) = 23 to 27.
   c. Ductility (ASTM D 113 at 77 degrees Fahrenheit, 5 cm/minute) = 125 cm, minimum.

2.04 ASPHALTIC PRIMER

A. Primer for base beneath bituminous setting bed and brick pavers shall be an emulsified asphalt rapid setting type conforming to AASHTO M 140, Grade RS-1, or AASHTO M 208, Grade CRS-1.

2.05 JOINT FILLER

A. Joint filler shall be polymeric sand. Color selected by Landscape Architect.

PART 3 – EXECUTION

3.01 ACCEPTABILITY OF REINFORCED CONCRETE BASE

A. Contractor shall examine the concrete base provided, installed and paid for under the work of the Division 32 Section, REINFORCED CONCRETE PAVEMENT to determine its adequacy to receive brick pavers and setting bed. Concrete shall have fully set prior to the work of installing brick pavers. Evidence of inadequate base shall be brought to the immediate attention of the Landscape Architect and shall be corrected by the Contractor as directed by the Landscape Architect at no additional cost to the Owner.

B. Start of work of this Division 32 Section, BRICK UNIT PAVERS, shall constitute acceptance of reinforced concrete base.

3.02 ASPHALT PRIME COAT

A. The surface of the base shall receive an asphalt prime coat before laying bituminous setting bed. Prime coat shall be applied at rate that will leave bituminous residue of 5 to 7 gallons per 100 square yards after evaporation of vehicle. Base surface shall be dry and clean when prime coat is applied. Bituminous setting bed shall not be placed until vehicle has completely evaporated from prime coat.

3.04 BITUMINOUS SETTING BED

A. Bituminous setting bed shall be installed over the fully dry asphalt prime coat. Control bars 3/4 inch deep shall be placed directly over the base. If grades must be adjusted, wood chocks under depth control bars shall be set to proper grade. Set two bars parallel to each other to serve as guides for the striking board. The depth control bars must be set carefully to bring the pavers, when laid, to proper grade.

B. While still hot 250 degrees Fahrenheit some of the bituminous bed material shall be placed between the parallel depth control bars. This bed shall be pulled with the striking board over the control bars several times. After each passage, low porous spots shall be showered with fresh bituminous material to produce a smooth, firm, and even setting bed. As soon as this initial panel is completed, advance the first bar to the next position in readiness for striking the next panel. After the depth control bars and wood chocks have been removed, carefully fill any depressions that remain.

C. The setting bed shall be rolled with a power roller to a nominal depth of 3/4 inch while still hot. The setting bed thickness shall be adjusted so that when the bricks are placed and rolled, the top surface of the pavers will be at the required finished grade.

D. A coating of neoprene-modified asphalt adhesive shall be applied by mopping, squeegeeing, or troweling over the top surface of the bituminous setting bed so as to provide a bond under the pavers.

1. If adhesive is trowel-applied, trowel shall be serrated type with serrations not to exceed 1/16 inch.

3.05 SETTING BRICK PAVERS

A. No pavers shall be laid in inclement weather or when the temperature is 36 degrees Fahrenheit, and dropping, nor shall any work be done on rising temperatures until the temperature reaches 32 degrees Fahrenheit. Frozen mortar materials shall not be used.

B. Brick pavers shall be on a bituminous setting bed over a prepared base. All setting shall be done by competent masons under adequate supervision.

C. Brick pavers with chips, cracks, stains, or other defects that might be visible in the finished work shall not be used.

D. After the modified asphalt adhesive is applied, carefully place the pavers by hand in straight courses with hand tight joints and uniform top surface.

E. Brick pavers shall be set true to the required lines and grades in the pattern detailed on the Contract Documents. Brick pavers shall be neatly cut and fitted at all perimeters and closures to fit neatly and closely, with joints uniform in thickness. Pavers shall be cut with a water-cooled, cut-off wheel masonry saw using a diamond blade. Cut edges shall be plumb and straight. Scoring and breaking shall not be acceptable.

F. Under work of brick paving, set boxes for valves and gates to final grade that is flush with adjacent brick pavement.

3.06 JOINT TREATMENT

A. Joints between pavers shall be hand tight and shall be uniform in thickness.

B. Joint filler shall be swept dry into the joints between pavers until the joints are completely filled. Surface shall be swept clean. Swept surface shall than be thoroughly dampened with a low-volume fine spray of water.

3.07 CLEANING AND PROTECTION OF BRICK SURFACES

A. After completion of brick paving, surfaces shall be carefully cleaned, removing all dirt, excess mortar, filler, and stains using the approved masonry cleaner. Follow the manufacturer’s directions for use. Apply masonry cleaner within the time frame noted in the manufacturer’s literature.

1. Test suitability of masonry cleaner on a test area for approval by the Landscape Architect. All test area to dry for the appropriate time period as described by Manufacturer’s product literature.

2. Protect all adjacent Landscape Architecture, pavement, lawns and planting from damage by masonry cleaner. Employ waterproof tarps and other appropriate barriers to prevent damage to adjacent materials.

3. After cleaning, rinse thoroughly with clean water per manufacturer’s written directions.

END OF SECTION 32 14 16
BRICK UNIT PAVERS

SECTION 32 30 00: SITE IMPROVEMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install designated Site Improvements and related items as indicated on the Contract Documents, as specified in this Section, and includes, but is not limited to, the following:

1. Site bench – refurbish
2. Resetting bike rack
3. Trench drain

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 03 Section – CAST-IN-PLACE CONCRETE
2. Division 04 Section – SITE MASONRY
3. Division 05 Section – FACTORY-APPLIED COATINGS FOR METALS
4. Division 26 Section – ELECTRICAL FOR EXTERIOR LIGHTING
5. Division 32 Section – ASPHALT PAVING
6. Division 32 Section – REINFORCED CONCRETE PAVING

1.04 REFERENCES

A. The following standards shall apply to the work of this Section:

1. Massachusetts Department of Transportation (MassDOT):
   Specifications Standard Specifications for Highways and Bridges

2. ASTM: American Society for Testing and Materials

1.05 SUBMITTALS

A. Shop Drawings and Manufacturer’s Product Literature

1. Trench drain

B. Samples: Submit samples of all finishes and colors from the manufacturer for the following:

1. Trench drain

C. Provide manufacturer’s warranties for all site improvements items.

1.06 QUALITY ASSURANCE

A. Environmental Compliance: comply with State and Local environmental regulations.

1.07 DELIVERY, STORAGE AND HANDLING

A. Do not deliver site amenities to the site, until all specified submittals have been submitted to, and approved by, the Landscape Architect.

B. Store products inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.08 GUARANTEE

A. The Contractor shall furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Division 32 Section, SITE IMPROVEMENTS, in addition to, and not in lieu of, guarantee requirements set forth under Division 01, GENERAL REQUIREMENTS, and other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

B. Supplier shall pay for repairs of any damage to any part of the project caused by defects in his work and for any repair to the materials or equipment caused by replacement. All repairs are to be done to the satisfaction of the Architect.

C. Any part of the work installed under this contract requiring excessive maintenance shall be considered as being defective, and shall be replaced by the Supplier during the one year guarantee period at no cost to the Owner.

PART 2 – PRODUCTS

2.01 GENERAL INSTALLATION

A. Where anchors, bolts or fasteners are exposed, they shall be configured or secured in such a way as to prevent their casual removal by use of vandal-proof heads or fastenings unless otherwise specified on Drawings.

B. Provision and delivery of all metal inserts, anchor slots, anchors, anchor bolts, fastenings, and other fastening devices, for attachment of trash receptacles, and recycle bins to concrete and masonry, except as otherwise specified under other Sections of this Specification, shall be provided by the manufacturer. Installation of all such fastening devices shall be part of the work of this Division 32 Section, SITE IMPROVEMENTS.

C. Free-standing site improvement items shall be set plumb and horizontal regardless of the pitch of the finished surrounding grade unless otherwise shown on the Contract Documents.

D. The Contractor shall be responsible for timing the delivery of site improvement items so as to minimize the on-site storage time prior to installation.

E. Contractor shall be responsible for the correct location of site improvement items according to the Contract Drawings. Take particular care to maintain shapes, plumb and level during the pouring of concrete.

F. All Work shall be accurately set to established lines and elevations and rigidly set in place to supporting construction.

2.02 SITE BENCH - REFURBISH

A. Refurbished site benches shall be those stockpiled from site; quantity (3) three.

1. Wood slats: Existing wood slats shall be removed from bench and replaced with new slats manufactured by Kenneth Lynch & Sons of Oxford, CT, (203) 264-2831.
   a. Contractor shall provide nine (9) slats per bench. Slats shall be ipe.
   b. Contractor shall provide to manufacturer dimensions for carriage bolts to secure wood slats to leg brace.
   c. Contractor shall provide 1/4-inch diameter stainless steel carriage bolts to secure wood slats to leg brace.

2. Metal components:
   a. All fabricated metal components shall be sandblasted, galvanized and powder-coated according to Division 05 Section – FACTORY-APPLIED COATINGS FOR METALS of this Specification.
   b. Color shall be “Black”.

3. Anchor: Benches shall be ground-mounted with 3/8” anchor bolts (to be provided by Contractor.)

4. Concrete footing shall be 4,000 psi, 28 day concrete. See Contract Documents for dimension of concrete pad as they will vary based on companion seating.

2.03 BIKE RACK

A. Bicycle rack shall be stockpiled from site; quantity (1) one. .

B. Anchor bolts shall be stainless steel.

C. Concrete footing shall be 4,000 psi, 28 day concrete.

2.04 TRENCH DRAIN

A. Trench drain shall be manufactured by ACO Polymer Products, Inc. of Mentor, Ohio. Model shall be KlassikDrain K100 galvanized steel edge rail or approved equal.

   1. Trench drain shall be four inches wide by length shown on Contract Drawings.

   2. Grate material shall be perforated and galvanized steel. Grate shall be ADA compliant. Channel shall be manufactured of polymer concrete.

   3. Trench drain shall have a compressive strength of 14,000 pounds per square inch and a flexural strength of 4,000 pounds per square inch.

B. Concrete footing shall be 4,000 psi, 28 day concrete.

2.05 PADS AND FOOTINGS

A. Concrete footings shall be 4,000 pounds per square inch (30MPa) cast-in-place concrete. Concrete pads shall be 3,000 pounds per square inch (20MPa) cast-in-place concrete.

B. Cast-in-place concrete for pads and footings shall be as specified and paid for under the work of Division 03 Section – CAST-IN-PLACE CONCRETE, of this Specification.

C. As noted in Contract Drawings, site amenities (benches, trash receptacles, and drinking fountains) adjacent to bituminous walkways shall be placed on concrete pad with bituminous wearing course.

   1. Site amenities placed on bituminous wearing course shall be set on hidden galvanized spacers required to ensure the amenity does not sink into the asphalt surface.

D. Bituminous concrete pavement shall be specified and paid for under the work of Division 32 Section – ASPHALT PAVING, of this section.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Beginning of installation means acceptance of existing project conditions.

3.02 SITE BENCH – ALL

A. Install to follow grade. Install benches in accordance with manufacturer's instructions at locations indicated on the Contract Drawings.

B. Drill holes for anchor bolts based on bolt pattern of installed bench. Drill diameter in accordance with bolt manufacturer instructions.

C. Set benches horizontal and square to concrete pavement unless otherwise shown.

D. Anchor benches to concrete footing with stainless steel anchor bolts.

3.03 BIKE RACK

A. Form and pour the concrete footings per the details.

B. Install bicycle rack per the manufacturer's instructions. Bike rack shall be surface-mounted.

C. Anchor bicycle rack to concrete footing with stainless steel anchor bolts.

3.04 TRENCH DRAIN

A. Form and pour the concrete footings per the details.

B. Install trench drain per the manufacturer's instructions.

END OF SECTION 32 30 00
SITE IMPROVEMENTS

SECTION 32 90 00: PLANTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Planting trees, perennials, bulbs
3. Planting maintenance
4. One-year guarantee period for all plants
5. Providing and placing backfill mix

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 32 Section – PLANTING SOILS

1.04 REFERENCES

A. The following standards shall apply to the work of this Section.

1. Hortus III, 1976, L. H. Bailey Hortorium
2. Tree and Shrub Transplanting Manual, E.B. Himelick, 1991, International Society of Arboriculture
3. American National Standards Institute (ANSI):
   Z60.1 American Standard for Nursery Stock, latest edition, published by American Nursery & Landscape Association, (ANLA)

1.05 SUBMITTALS

A. Submit proof of landscape contractor's experience to the Landscape Architect in accordance with QUALITY ASSURANCE paragraph of this Section, PLANTING.

B. At least 30 days prior to ordering materials, the Contractor shall submit to the Landscape Architect representative samples, certifications, manufacturer's product data and certified test results for materials as specified below. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Landscape Architect. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Landscape Architect reserves the right to reject, on or after delivery, any material which does not meet these Specifications.

C. Material Sampling and Testing:

1. Material Sampling and Testing of Loam Borrow from Off-Site Sources shall be specified, performed and paid for under the work of the Section, PLANTING SOILS, of this Specification. Testing of the off-site loam borrow shall occur in place after the loam has been spread and represents a second testing of the off-site loam borrow. The first sampling and testing shall have occurred prior to delivery of the loam as specified, performed and paid for under the work of the Section, PLANTING SOILS, of this Specification. Additional sampling and testing of delivered

and stockpiled loam or delivered and spread loam to verify that it meets the test results submitted for approval under the Section, PLANTING SOILS, shall not be abrogated by the language of this Section, PLANTING.

2. Material Sampling and Testing of On-Site Loam: On-site loam shall be sampled and tested as specified, performed and paid for under the Section, PLANTING SOILS, of this Specification.
3. Planting Mulch: Submit a one cubic foot sample.
4. Anti-desiccant: Submit manufacturer's product data.
5. Peat: Submit a one cubic foot sample and manufacturer's certification of contents.
6. Tree Staking System: Submit manufacturer's product data of system.
7. Soil Additives: Submit manufacturer's product data for all soil additives needed to amend a specific soil in order to meet the requirements of this Section, PLANTING.

1.06 EXAMINATION OF CONDITIONS

A. All areas to be planted shall be inspected by the Contractor before starting work and any defects such as incorrect grading or inadequate drainage shall be reported to the Landscape Architect prior to beginning this work.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved, including but not limited to the potential need for storing and maintaining plants temporarily and/or re-handling plants prior to final installation.

C. All plants are the full responsibility of the Contractor between the time of digging at the nursery and final acceptance.

1.07 QUALITY ASSURANCE

A. Qualification of Landscape Contractor: The work of this Section, PLANTING, shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years' experience. Proof of this experience shall be submitted per SUBMITTALS paragraph of this Section, PLANTING.

PART 2 – PRODUCTS

2.01 LOAM BORROW

A. Loam borrow for planting shall be specified, provided, installed and paid for under the work of the Section, PLANTING SOILS, of this Specification.

2.02 SOIL ADDITIVES

A. Soil additives shall be specified, provided, installed and paid for under Section, PLANTING SOILS, of this Specification.

2.03 GRADES AND STANDARDS OF PLANTS

A. The Contractor shall furnish all plants shown on the Contract Documents, as specified, and in quantities listed on the PLANT SCHEDULE. No substitutions will be permitted, without written approval by the Landscape Architect. All plants shall be nursery grown unless specifically authorized to be collected as noted on the PLANT SCHEDULE.

B. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. Only plant stock grown within Hardiness Zones 1 through 6b, as established by the USDA Plant Hardiness Zone Map, latest edition, will be accepted.

C. Plants shall be in accordance with ASNS Standards of the American Nursery & Landscape Association except as noted in this Section, PLANTING. Botanical plant names shall be in accordance with plant designations included in Hortus III.

D. If, at any time during the performance of the Contract, any plant shows signs of graft incompatibility, as determined by the Landscape Architect, then the tree or shrub and all other similarly grafted plants of the same Genus/Species/Variety shall be rejected and removed from the site. Visual symptoms of graft incompatibility as cause for rejection include:

1. Development of over-growths by rootstock or scion resulting in the development of shoulders or inverted shoulders.
2. Suckering of the rootstock combined with poor growth or dieback of scion.
3. Any mechanical weakness between scion and rootstock.
4. Any marked difference in bark pattern and structure between scion and rootstock.

E. All deciduous trees shall meet the following standards:

1. Trees shall have a single, straight trunk, well formed, and sturdy. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety.
2. Trees with multiple leaders shall conform to all standards noted in this Section, PLANTING for single leader trees and shall be accepted only as noted on the PLANT SCHEDULE.
3. All pruning wounds shall show vigorous bark on all edges at the time of harvest. Trees shall be free from all signs of pest and disease damage. The trunk shall be free from sun scald, frost cracks, and wounds resulting from abrasions, fire, animal damage, or other causes.
4. Pruning scars within the crown of any tree shall be clean cut and shall leave no protrusion beyond the branch collar.
5. All trees shall have healthy, vigorous leaves or needles of normal size, color, shape, and texture for the particular species and variety.
6. Deciduous shade trees and deciduous flowering trees shall have fall color typical for their species and variety.
7. Unless otherwise indicated on the PLANT SCHEDULE, the height and spread of deciduous shade trees shall be the minimum requirements.
8. Take caliper measurements for deciduous trees 6 inches above ground level up to and including 4 inches caliper size and 12 inches above ground for larger sizes.
9. No deciduous tree shall be pruned after the Landscape Architect has tagged the plant in the nursery except as directed by the Landscape Architect.
10. Unless otherwise noted on the PLANT SCHEDULE, shade trees for use in paved areas shall have no branches lower than 6.5 feet from finish grade and no higher than 7.5 feet from finish grade. Flowering trees for use in areas away from pedestrian traffic shall have the first branch of their crowns no higher than 4 feet from finish grade.
11. Branching of all deciduous trees shall be best quality representatives of the species, cultivar or variety with lateral branching around the entire trunk to form a symmetrical tree for 80 percent to 100 percent of the tree's outer perimeter. All branches on deciduous trees shall meet the trunk at angles no less than 30 degrees and no greater than 90 degrees from the vertical.

2.04 ROOT SYSTEMS FOR ALL PLANTS

A. Each plant shall have an extensive, symmetrically balanced fibrous root system. Any root ball which shows signs of asymmetry, girdling, injury, or damage to the root system shall be rejected.

B. Curling or spiraling of the roots along the walls of rigid containers will not be accepted. Curling, spiraling or girdling roots within balled and burlapped material will not be accepted.

C. All parts of the fibrous root system of all plants shall be moist and fresh with a white color when washed of soil. When the plant is removed from the container, the visible root mass shall be healthy with white root tips. The root systems of all plants shall be free of disease, insect pests, eggs, or larvae.

D. All trees which are not grown in containers must be moved with the root systems as solid units with balls of earth firmly wrapped with untreated 8 ounce natural, biodegradable fabric burlap, firmly laced with stout, natural biodegradable cord or twine. The base of the tree trunks shall be wrapped with a protective burlap layer, surrounded by a cardboard trunk protector, and loosely tied with twine.

E. The diameter and depth of the balls of earth must encompass the fibrous and root feeding system necessary for the healthy recovery of the plant. Minimum root ball diameters and depths shall be in accordance with ASNS standards.

F. No plants shall be loose in the container.

G. Container grown plants which have roots growing out of the container will be rejected.

2.05 PLANTING SOIL MIX

A. Planting soil mix shall be an approved loam borrow specified, provided, installed and paid for under the Section, PLANTING SOILS, of this Specification and that has been pH adjusted according to particular planting applications and improved through the addition of organic matter as directed below. Planting loam shall conform to the following pH levels:

1. Planting soil mix for general planting of non-acid loving plants shall have a true pH value of 6.0 to 6.5. Planting soil mix shall be amended by the Contractor at his own expense to the proper pH range by mixing with dolomitic limestone as specified, provided, installed and paid for under the Section, PLANTING SOILS, of this Specification.

2. The amount of either sulfur or limestone required to adjust the planting soil mix to the proper pH range shall be approved by the Landscape Architect on the basis of soil tests as specified, provided, installed and paid for under the Section, PLANTING SOILS, of this Specification.

3. In those areas indicated on the Contract Documents, augment planting soil mix with 10 percent gypsum. Thoroughly premix gypsum into planting soil mix prior to commencing the planting operations. Gypsum shall be specified, provided, installed and paid for under the Section, PLANTING SOILS, of this Specification.

2.06 MULCH

A. Bark Mulch: Mulch shall be high quality, double-ground, premium bark mulch of 70 percent hemlock bark with the balance spruce and pine bark. Mulch shall have been aged for a minimum of six months and not longer than two years. Bark mulch shall be shredded to a uniform size; free of dirt, debris and foreign matter; with pieces no thicker than one-quarter inch. Mulch must be free of stringy material or chunks over 3 inches in size and shall not contain, in the judgment of the Owner’s Representative, an excess of fine particles. Submit sample for the Owner’s Representative's approval.

2.07 WATER

A. The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be responsible to furnish adequate supplies at his own cost. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

B. Watering bags shall be installed around each deciduous tree. Watering bags shall be capable of releasing 20 gallons of water over a 24 hour period.

1. Contractor shall remove the water bags at Final Completion or remain for future removal at the Owner’s discretion.

2.08 ANTI-DESICCANTS

A. Anti-desiccants shall be emulsions or other materials which will provide a protective film over plant surfaces permeable enough to permit transpiration and specifically manufactured for that purpose. Manufacturer of anti-desiccant shall be subject to the Landscape Architect's approval and shall be used only after approval by the Landscape Architect. Anti-desiccant shall be delivered in containers of the manufacturer and shall be mixed and applied according to the manufacturer's instructions.

PART 3 – EXECUTION

3.01 PLANTING

A. Furnishing and planting of plant material shall include, but shall not be limited to, the digging of planting pits and plant beds, amendment of loam as required to produce planting soil mix, provision of soil additives required to adjust for pH requirements of specific plants, furnishing the plants as specified as well as the labor of planting, fertilizing, and maintenance.

B. Prior to spreading of loam, subgrades shall have been tested to determine if they are too compact to drain water as specified, performed and paid for under the work of Section, PLANTING SOILS, of this Specification.

C. The Contractor shall locate plant material sources and ensure that plants are shipped in timely fashion for installation.

D. Contractor shall locate all existing underground utilities that are within 10 feet (3 meters) of the proposed planting pits and notify the Landscape Architect of any conflicts prior to digging plant pits.

E. Seasons for Planting:

1. Spring: Deciduous materials – March 21 through May 1
2. Fall: Deciduous materials – October 1 through December 1

F. Plant Material Inspection:

1. At a minimum of 21 days after the Notice to Proceed, the Contractor shall identify the supplying nursery or nurseries for approval. At least one month prior to the expected planting date, the Contractor shall request that the Landscape Architect provide a representative to select and tag stock to be planted under this Section, PLANTING. The Contractor shall pay for the transportation, subsistence and overnight accommodations, if necessary, for the Landscape Architect's representative during the period of time required to select and tag the plant material.

2. The Contractor shall be responsible to certify the availability of quality plants in specified sizes from his/her sources of supply prior to requesting that the Landscape Architect make plant source inspections. In the event that plants at the inspection location are found to be unavailable or of insufficient size, the Contractor shall be liable to reimburse the Owner for all costs of the Landscape Architect's hourly services which are incurred during unproductive inspection trips.

3. Unless specifically designated otherwise, a representative of the Contractor shall accompany the Landscape Architect on all plant material selection field trips.

4. All trees for the project shall be individually tagged for approval with the Landscape Architect's seals, and no trees shall be accepted for delivery to the site without such seals.

5. Plants to be inspected shall be in locations and conditions that allow direct and un-obscured inspection by the Landscape Architect. Harvested trees held in storage shall not have branches tied up. Harvested trees shall not have trunks obscured by burlap, cardboard trunk protection, or other devices that would otherwise obscure inspection. In the event that branches are tied up, trunks are obscured by burlap or cardboard trunk protection, or root flares hidden by burlap and twine and the Landscape Architect cannot inspect root flares, trunks or branching habit, the Contractor shall bear all responsibility and costs associated with tree rejection at a later date during the course of the Contract.

6. Inspection and approval of plants at the source shall not impair the right of subsequent inspection and rejection upon delivery to the site, or during the progress of the work if the Landscape Architect finds that plants do not meet the requirements of the PLANT SCHEDULE

or this Contract, have declined noticeably due to handling abuse, lack of maintenance, or other causes. Cost of replacements, as required, shall be borne by the Contractor.

G. Placement of Loam for planting soil shall be specified, performed and paid for under the work of Section, PLANTING SOILS, of this Specification. Obtain Landscape Architects written approval of work of rough grading and finish grading prior to starting the work of planting.

H. Planting:

1. Notify the Landscape Architect three working days prior to the proposed arrival of plant material on the site. If not planted within 24 hours of delivery to the site, all plants shall be maintained in an on-site nursery. Container grown shrubs stored on site shall be shaded from direct sunlight at all times and shall not be stored directly on paved surfaces. All plants delivered to the site and not planted within 24 hours of delivery shall have their root balls covered with mulch and shall be watered on a daily basis such that root balls are kept moist throughout.

2. Locations for all plants and outlines for planting areas shall be staked on the ground by the Contractor for approval by the Landscape Architect before any plant pits or plant beds are dug. Notify the Landscape Architect no less than 3 days prior to desired date of inspection of staking to schedule site visit.

3. Circular plant pits shall not be required provided that the minimum dimension between the edge of the pit and the face of the rootball is not less than required by this Section, PLANTING.

4. All plant pits dug with a machine shall have the sides of the holes scraped with hand shovels to prevent glazing or compaction of the sides of the hole. Remove and stockpile excavated loam for reuse as backfill for plant pit. All subsoil excavated from the bottoms of planting pits shall be removed from the site.

5. Plant pits shall be dug to the dimensions shown on the Contract Documents.
   a. Plant pits for trees shall be a minimum three times greater in diameter than the diameter of the root ball. Place root ball directly on subgrade. Slope sides of tree pits at a 45 degree angle.
   b. Plant pits for trees and shrubs shall be dug to the depth of the rootball to be planted.
   c. Remove all soil from around the root flare of the stem of the plant and from the top of the rootball to determine the true depth of the rootball. All plants that have been planted and have root flares that are buried will be rejected.

5. All plant roots and earth balls must be damp and thoroughly protected from sun and wind from the beginning of the digging operation, during transportation, and at the site until the final planting.

6. Remove container plants from containers prior to planting.

7. Trees shall be placed in the center of plant pits, plumb, with the crown of their roots exposed and located above the surrounding finish grade.

8. Prior to completion of planting installations, remove rope and cut wire baskets from the top 1/3 of the root balls. Pull burlap away from the trunk or stem of the plant and cut burlap from the top 1/3 of the root balls.

9. Planting soil shall be backfilled with approved planting soil to the full depth of the planting pit or bed. Eliminate air pockets and compact the soil by flooding the tree pit or plant bed within 2 hours of planting installation. After water has drained from the planting pit or bed and planting backfill has dried enough additional planting soil shall be spread in pit or bed to bring the finished surface of the planting pit or bed to grades shown on the Contract Documents. A saucer shall be formed around each plant at a depth of 3 inches for trees.

11. Fertilizer shall be spread over the plant saucer or plant bed between the saucer and the edge of the rootball. Till the fertilizer into the soil to a depth of four inches prior to the placement of the planting mulch. Fertilizer shall be provided, spread and paid for under the Section, PLANTING

SOILS, of this Specification. Do not mulch until placement of the fertilizer has been verified by the Landscape Architect. Fertilizer application rates shall be as determined by soil testing, analysis, and testing laboratory recommendations specified, performed and paid for under the Section, PLANTING SOILS, of this Specification.

I. All plants shall be watered immediately following planting as necessary to thoroughly moisten rootball and plant pit loam and thereafter shall be inspected frequently for watering needs and watered, as required, to provide adequate moisture in the planting pit. The Contractor shall inspect tree pits 24 hours after initial watering to confirm that they are draining properly. If surface water or excessively saturated plant pit soils exist, the Contractor shall immediately notify the Landscape Architect. The Landscape Architect will recommend remedial measures based upon site conditions.

J. Keeping Trees Plumb:

1. Contractor shall keep trees plumb and upright at all times.

K. Mulch material shall be placed over entire saucer areas of individual trees and shrubs and over the entire area of planting beds to a depth of 3 inches after settlement, not later than one week after planting. Do not apply mulch prior to the first watering of plant materials. Do not apply mulch prior to placement of surface applied fertilizer and verification of placement by the Landscape Architect.

L. The trunks of all deciduous trees over 1-1/2 inches in diameter shall be wrapped by the Contractor immediately after the inspection of the trees by the Landscape Architect. Wrapping shall extend from the ground line to the height of the second branches or to the height directed. The specified wrapping shall be wound spirally, starting from the base and overlapping 1-1/2 inches in order to shed water. Wrapping shall be securely taped to prevent loosening and unraveling. If trees are planted in springtime, do not apply any tree wrapping. If deciduous trees are planted in the autumn, wrap the trees and then remove wrapping the following spring.

1. Trees delivered to the site wrapped for protection shall be unwrapped at the site for inspection of the trunk by the Contractor and Landscape Architect.

M. Pruning:

1. As directed by the Landscape Architect, each plant shall be pruned in accordance with the workmanship requirements of "Pruning Standards" for Class I, fine pruning, to preserve the natural character of the plant.

2. Tree pruning, as required, shall be undertaken to the full height of affected trees.

3. All dead wood or suckers and all broken or badly bruised branches shall be removed. Never cut a leader.

N. If planting is done after lawn preparation or installation, proper protection of lawn areas shall be provided. Any damage resulting from planting operations shall be repaired immediately at no cost to the Owner. Repair work shall be as specified and installed under the work of Section, SEEDING, of this Specification and paid for under this Section, PLANTING.

O. Absolutely no debris may be left on the site. Repair any damage to site as directed by the Landscape Architect, at no additional cost.

3.02 MAINTENANCE

A. Maintenance shall begin immediately after each plant is planted and shall continue for a minimum 90-day Monitoring Period within the growing season and until Final Acceptance. The growing season is from April 1 to November 1.

B. Maintenance shall consist of keeping the plants in a healthy growing condition and shall include but is not limited to watering, weeding, cultivating, pruning, re-mulching, tightening and repairing of guys, straightening of trees to a plumb position, removal of dead material, resetting plants to proper grades or upright position, and maintaining the planting saucer.

1. Plants shall be inspected for watering needs at least twice each week and watered to promote plant growth and vitality. The following watering rates assume that the soil is free draining. If the on-site conditions do not ensure a free draining soil, then notify the Landscape Architect in writing of this condition. Watering rates in free draining soils are presented here as guidelines to ensure that the top six inches of plant bed soil remains moist at all times. Actual watering rates may vary depending upon soil conditions. Guideline rates shall be as follows:

Type of Plant/Size	Weekly Watering Rate
Deciduous Trees:	
1 - 1-1/2 in. caliper	40 gallons
1-1/2 - 2 in. caliper	54 gallons
2 - 2-1/2 in. caliper	61 gallons
2-1/2 - 3 in. caliper	70 gallons
3 - 3-1/2 in. caliper	80 gallons

   a. Water shall be applied by 1 inch diameter hose with an attached metering gauge.

3. For trees, apply water into the watering bag.

4. Stakes shall be kept plumb and neat in appearance. Guys, wires and anchoring cables shall be tightened and repaired weekly.

5. Individual plant pits shall be kept free of weeds, and mulch shall be replaced as required to maintain the specified layer of mulch. Individual pits shall be neat in appearance and maintained to the designed layout.

6. Plants that die during the maintenance period shall be removed and replaced by the Contractor within one week of notification and replaced during that growing season, unless directed otherwise by the Landscape Architect.

7. Spraying of insecticides or herbicides shall be done by State-licensed professionals. Spraying for insects, pests and diseases shall conform to the National Arborist Association Standards under the section entitled "Standards for Pesticide Application Operations", as currently adopted and as approved by the Landscape Architect. All insecticides, pesticides, and herbicides shall be EPA-approved and shall conform to the requirements of the State of Rhode Island.

7. Work of pruning, fertilizing, spraying, and similar activities shall be undertaken only by Certified Arborists and licensed chemical applicators, as pertinent to the work being performed.

C. During the maintenance period, any decline in the condition of plantings shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and/or horticulturalists to inspect plant materials and to identify problems and recommend corrective procedures. The Landscape Architect shall be immediately advised of such actions. Inspection and recommendation reports shall be submitted to the Landscape Architect.

D. Contractor is responsible for watering the entire park for the duration of construction.

3.03 ACCEPTANCE

A. Upon completion of all planting work, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work.

B. If plant materials and workmanship are acceptable, the Landscape Architect will issue a written Certificate of Conditional Acceptance to the Contractor.

C. Following the issuance of the Certificate of Conditional Acceptance to the Contractor, the Contractor shall maintain the plants for a minimum 90 day Monitoring Period. At the end of the Monitoring Period, the plant material will be inspected by the Landscape Architect to determine whether or not all planting work has been performed to the requirements of this Section, PLANTING.

D. Acceptance Standards at end of the Monitoring Period: If plant material is reviewed when it is in full leaf, leaves shall be plump with water with a shape indicative of the species and shall be free of insect, pest and disease damage. Twigs shall have living cambium for their full length. Twigs and branches shall have a full bud set for their full length, including terminal buds. Trunks and branches shall be free of frost cracks; sun scald; damage due to insects, pests, and disease; structural defects; and damage resulting from machinery or tools. Plant material inspected and reviewed when the plants are not in full leaf shall have twigs, branches and trunks meeting the above requirements. All plants regardless of the season of review shall have a minimum of 75 percent healthy, balanced branching structure with a healthy terminal leader(s) with viable terminal bud(s).

E. If any number of plants do not meet these Acceptance Standards at the time of inspection, or if in the Landscape Architect's opinion, workmanship is unacceptable, written notice will be given by the Landscape Architect to the Contractor in the form of a punch list, which itemizes necessary planting replacements and/or other deficiencies to be remedied. The Contractor's responsibility for maintenance of all plants shall be extended until replacements are made or other deficiencies are corrected. All plants that do not meet these Acceptance Standards shall be removed from the project within seven days of receipt of the punch list. Replacements shall conform in all respects to the Specifications for new plants and shall be planted in the same manner

F. Following the correction of all Punch List deficiencies, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work. If plant materials and workmanship are acceptable, the Landscape Architect will issue a written Certificate of Final Acceptance to the Contractor.

3.04 GUARANTEE

A. The date of the Certificate of Final Acceptance shall establish the commencement of the required one-year guarantee and establishment period for planting work.

B. During the guarantee period, Contractor shall replace dead/damaged plants at their expense.

C. At the end of the guarantee and establishment period, a final inspection will be held to determine whether any plant material replacements are required. Each plant shall be plumb, shall have a character that is natural for its species as determined by the Landscape Architect, and shall conform to the Acceptance Standards described in this Section, PLANTING. Plants found to be unacceptable shall be removed promptly from the site and replaced according to this Section, PLANTING. A final inspection will be made after the replacement plants have lived through one year.

D. At the end of the one-year guarantee and establishment period, remove all tree stakes, guys, or anchors installed on trees during the course of the work of this contract.

E. All replacements shall be plants of the same kind and size specified in the PLANT SCHEDULE. The cost shall be borne by the Contractor, except for possible replacements due to vandalism or neglect on the part of others.

END OF SECTION 32 90 00
PLANTING

SECTION 32 91 13: PLANTING SOILS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to supply and place planting soils as indicated on the Contract Documents and as specified. Supplying and placement of planting soils shall include, but not be limited to:

1. Sampling and testing of loam borrow.
2. Modifying, screening, placing, spreading and grading of loam borrow.
3. Providing all other sampling, testing, supplying, placing, spreading and grading of planting soils as required by this Section.

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 31 Section – EARTH MOVING
2. Division 32 Section – PLANTING
3. Division 32 Section – TURF & GRASSES

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):
D 75 Practice for Sampling Aggregates
D 422 Test Method for Particle-Size Analysis of Soils
D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
D1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb Rammer and 18-in. Drop

B. A.O.A.C.: Association of Official Agricultural Chemists.

1.05 SUBMITTALS

A. At least 30 days prior to ordering materials, the Contractor shall submit to the Landscape Architect representative samples, certifications, manufacturer's product data and certified test results for materials as specified below for approval in conformance with the requirements of Section, SUBMITTALS, of this Specification. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Landscape Architect. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Landscape Architect reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

1. Loam Borrow: The Contractor shall provide a one cubic foot representative sample for testing. All stockpile sampling shall be per ASTM D 75 and Appendixes for securing samples from stockpiles.

Testing will be at the Contractor's expense. Contractor shall deliver all samples to testing laboratories via overnight courier and shall have the testing report sent directly to the Landscape Architect. Perform all tests for gradation, organic content, soil chemistry and pH by UMASS Soil

and Plant Tissue Laboratory, West Experiment Station, North Pleasant Street, University of Massachusetts, Amherst, MA 01003, (413) 545-2311.
Testing reports shall be dated within 30 days of submission to the Landscape Architect. Testing reports beyond 30 days old will be rejected and new testing reports mandated.

Testing reports shall include the following tests and recommendations. Contractor shall deliver samples to testing laboratories and shall have the testing report sent directly to the Landscape Architect from the Soil and plant Tissue Laboratory. Testing reports shall include the following tests and recommendations.

a. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System. Sieve analysis shall be by combined hydrometer and wet sieving using sodium hexametaphosphate as a dispersant in compliance with ASTM D 422 after destruction of organic matter by H_2O_2. To facilitate review and approval of sieve analysis, provide a computer generated gradation curve from UMASS Soil & Plant Tissue Laboratory.
b. Percent of organics shall be determined by the loss on ignition of oven-dried samples. Test samples minus #10 material shall be oven-dried to a constant weight at a temperature of 450 degrees Fahrenheit (752 degrees Centigrade).
c. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, extractable Aluminum, Lead, Zinc, Cadmium, Copper, Soluble Salts, and pH and buffer pH. A Conductivity Meter shall be used to measure Soluble Salts in 1:2 soil/water (v/v). Except where otherwise noted, nutrient tests shall be for available nutrients.
d. Soil analysis tests shall show recommendations for soil additives to correct soils deficiencies as necessary, and for additives necessary to accomplish lawn and planting work as specified.

2. Peat Moss: Submit a one cubic foot sample and supplier's certification of contents.
3. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications.
4. Acidulant: Submit supplier’s certification that the acidulant being supplied conforms to these Specifications.
5. Fertilizer:
   a. Submit product data of planting fertilizer and certificates showing composition and analysis. Submit fertilization rates for fertilizer product based upon soil testing, analysis, and recommendations as specified, performed and paid for under in this Section, PLANTING SOILS.
   b. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation.
6. Gypsum: Submit manufacturer's product data and 2 pound sample.
7. All additives needed to amend a specific soil in order to meet these specifications.

1.06 EXAMINATION OF CONDITIONS

A. All areas of the existing site where topsoil is to sampled for testing shall be inspected by the Contractor before starting work and any issues that might inhibit or prevent the sampling operation shall be reported to the Landscape Architect prior to beginning this work.

B. The Contractor and any sub-Contractor responsible for the execution of the Work of this Section, PLANTING SOILS, shall review and confirm in writing that the subsoil elevations have been brought to the proper subgrade elevations prior to proceeding with the spreading of the loam borrow.

PART 2 – PRODUCTS

2.01 LOAM

A. Loam borrow shall be one of the following loamy sands and sandy loams; “loamy sand”, “loamy fine sand”, “loamy very fine sand”, or “coarse sandy loam”: determined by mechanical analysis (ASTM D 422) and based on the "USDA Classification System" and as defined in this Section. It shall be of uniform composition, without admixture of subsoil. It shall be free of stones greater than 0.75 inches lumps, plants and their roots, debris and other extraneous matter as determined by the Landscape Architect.

Planting soil for lawn areas shall have the following grain size distribution for material passing the #10 sieve:

Millimeter	Percent Passing by Weight	
	Maximum	Minimum
2	-------	100
1	100	82
0.5	87	65
0.25	72	49
0.10	45	30
0.05	32	22
0.002	5	2

1. Maximum size shall be one and one quarter inches largest dimension. The maximum retained on the #10 sieve shall be 25% by weight of the total sample.
2. The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 6.0 or less. ($D_{80}/D_{30} < 6.0$).
3. In addition to the foregoing, all loam borrow to be used for loaming shall be mechanically screened processed loam borrow that passes a 3/4 inch by 6 inch (19 mm by 150 mm) screen size.

B. Organic content and pH for specific planting use shall be as follows:

1. Top 18 inches (450 mm) of areas planted with tree and shrub as described in the Section 32 90 00, PLANTING, of this Specification:
   a. pH: 5.5 through 6.5 for non-acid loving plants
   b. pH: 4.5 through 5.5 for *Ericaceae* and other acid-loving plants
   c. Organic Content 4.0 - 6.0 percent as determined by the loss on ignition of oven-dried samples passing #10 sieve (Muffle furnace temperature: 450 +/- 10 degrees C for 8 hours)
2. Loam borrow shall be pH adjusted for particular planting applications and shall be adjusted prior to delivery to the Project sites as recommended by UMASS Soil & Plant Tissue Laboratory test results.
   a. When pH of loam borrow is equal to or greater than 7 use aluminum sulfate to adjust pH downward to required levels.
   b. When pH of loam borrow is less than 7 use either sulfur or ferrous sulfate to adjust pH downward to required levels.
   c. When pH of loam borrow must be raised to the required levels use limestone.
   d. Regardless of amendment Contractor chooses to use, Contractor, not the Owner, shall be responsible for obtaining specified pH by planting time.

C. All loam borrow proposed for use shall be tested for conformance to the specifications. Soil additives shall be used to counteract soil deficiencies as recommended by the soils analysis and as supplements for lawn construction as specified herein.

D. The Landscape Architect reserves the right to reject on or after delivery to the project site any material which does not, in his opinion, meet these specifications.

PART 3 – EXECUTION

3.01 FILLING AND COMPACTION

A. Subsoil or ordinary borrow shall have been excavated and filled as required by the Contract Documents and specified and paid for under the Section, EARTH MOVING, of this Specification. Do not damage the work previously installed. Maintain all required angles of repose of materials adjacent to the loam as shown on the Contract Documents. Do not over excavate compacted subgrades of adjacent pavement or structures during loaming operations.

B. Confirm that the subgrade is at the proper elevation and that no further earthwork is required to bring the subgrade to proper elevations. Subgrade elevations shall slope parallel to the finished grade and or toward the subsurface drain lines as shown on the Contract Documents.

C. Clear the subgrade of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Such construction debris, trash, rubble and foreign material shall be removed from the site and disposed of in a legal manner. Fill any over excavation with approved fill and compact to the required subgrade compaction levels.

D. Do not proceed with the installation of loam borrow until all utility work in the area has been installed.

E. Protect adjacent walls, walks and utilities from damage or staining by the loam borrow. Use 0.5-inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.

3.2 FINE GRADING

A. Place loam in two lifts. Place the first lift to a depth of 2 inches and harrow or till the loam into the underlying subsoil to a depth of 2 inches, creating a blended interface of loam and subsoil approximately 4 inches deep. Spread the second lift of loam to a minimum depth of 4 inches or greater as shown on the Contract Documents.

B. No loam borrow shall be handled, planted in any way if it is in a wet or frozen condition. A moist loam borrow is desirable.

C. Soil additives shall be spread and thoroughly incorporated into the layer of loam borrow by harrowing or other methods reviewed by the Landscape Architect. The following soil additives shall be incorporated:

1. Ground limestone or acidulant as required by soil analysis to achieve the required Ph.
2. Fertilizer at the rate and of analysis recommended by the soil analysis
3. Other soil amendments as required by soil analysis.

D. Sufficient grade stakes shall be set for checking the finished grades. Stakes must be set in the bottom of swales and at the top of slopes. Deviation from indicated elevations that are greater than one-tenth of a foot shall not be permitted. Connect contours and spot elevations with an even slope. Finish grades shall be smooth and continuous with no abrupt changes at the top or bottom of slopes.

E. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional loam borrow and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

F. The Contractor shall install loam borrow in successive horizontal lifts no thicker than 6 in turf areas and 12 inches in plant bed areas to the desired compaction as described herein. The Contractor shall install the soil at a higher level to anticipate any reduction of loam borrow volume due to compaction, settling, erosion, decomposition, and other similar processes during the warranty period. The Landscape Architect will ensure that the full depths of loam borrow for lawn and plant beds are obtained by digging holes in the loam borrow at the same frequency as for compaction testing.

1. Compact loam to the required density as specified herein.
2. Maximum dry density for topsoils and loam shall be determined in accordance with ASTM D698. The following percentages of minimum to maximum dry densities shall be achieved for fill materials or prepared subgrades.

In lawn and plant beds:

	Minimum	Maximum
a. Fills within planting areas in top eighteen inches of finished grade	80%	85%

3. The surface area of each lift hall shall be scarified by raking prior to placing the next lift.

G. Select equipment and otherwise phase the installation of the loam borrow to ensure that wheeled equipment does not travel over subsoil, placed fills or ordinary borrow or already installed soil.

H. Disturbed areas outside the limit of lawn work shall be graded smooth and spread with a minimum of 6 inches of loam borrow to the finished grade.

I. Annual planting beds shall be graded smooth and spread with a minimum of 12 inches of loam borrow to the finished grade.

3.03 ACCEPTANCE

A. Confirm that the final grade of the loam borrow is at the proper finish grade elevations. Adjust grade as required to meet the contours and spot elevations noted on the Plans. Request the presence of the Landscape Architect to inspect final grade. Do not proceed with the remaining work of this Contract until the Landscape Architect has given his/her written approval of the final grade.

END OF SECTION 32 91 13
PLANTING SOIL

SECTION 32 92 19 – TURF & GRASSES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 01, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SUMMARY

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all lawn installation and fine grading work and related items as indicated on the Contract Documents and/or as specified in this Section and includes, but is not necessarily limited to, the following:

1. Seeding
2. Maintenance and protection

1.03 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Division 32 Section – PLANTING
2. Division 32 Section – PLANTING SOILS

1.04 REFERENCES

A. Not Applicable.

1.05 SUBMITTALS

A. Submit proof of landscape contractor's experience to the Landscape Architect in accordance with Quality Assurance paragraph of this Section.

B At least 30 days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with the requirements of Section, Submittals. Do not order materials until Landscape Architect’s approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples. Acceptance shall not constitute final acceptance. The Landscape Architect reserves the right to reject on or after delivery any material that does not meet these Specifications.

1. Material Sampling and Testing of Loam Borrow from Off-Site Sources shall be specified, performed and paid for under Section, Planting Soils, of this Specification.

2. Fertilizer:
   a. Submit product literature of seeding fertilizer and certificates showing composition and analysis.
   b. Submit the purchasing receipt showing the total quantity purchased for the project prior to installation.

2. Seed: Submit a manufacturer's Certificate of Compliance to the Specifications with each shipment of each type of seed. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net

weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.

3. Hydroseeding: Prior to the start of hydroseeding, submit a certified statement for approval as to the number of pounds of materials to be used per 100 gallons of water.

4. Wood Cellulose Fiber Mulch: Submit copies of manufacturer's literature and one material sample.

5. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications.

6. All additives needed to amend a specific soil in order to meet these specifications.

1.06 EXAMINATION OF CONDITIONS

A. All areas to be improved shall be inspected by the Contractor before starting work and any defects such as incorrect grading, or drainage problems shall be reported to the Landscape Architect prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be improved, and he shall assume full responsibility for the work of this Section, Seeding.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved.

1.07 QUALITY ASSURANCE

A. Qualification of Landscape Contractor: The work of this Section, Seeding, shall be performed by a landscape contracting firm which has successfully installed work of a similar quality, schedule requirement, and construction detailing with a minimum of five years' experience. Proof of this experience shall be submitted per Submittals paragraph of this Section, Seeding.

B. Qualification of Foreman or Crew Leader: All work of seeding shall be supervised by a foreman or crew leader who is a certified landscape professional or a certified horticulturist.

1. Certification shall be current. Proof of certification shall be submitted per Submittals paragraph of this Section, Seeding.

PART 2 – PRODUCTS

2.01 LOAM

A. Loam borrow shall be specified, provided, installed and paid for under the work of the Section, Planting Soils, of this Specification.

2.02 SOIL ADDITIVES

A. Soil additives shall be specified, and provided under Section, Planting Soils

2.03 TURF SEED

B. Grass Seed: Fresh, clean, dry, new-crop seed complying with Association of Official Seed Analysts' "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

C. Seed mixture shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and in no case shall the weed seed content exceed 0.25% by weight. The seed shall be furnished and delivered in the proportion specified below in new, clean, sealed and properly labeled containers.

All seed shall comply with State and Federal seed laws. Submit manufacturer's Certificates of Compliance. Seed that has become wet, moldy or otherwise damaged shall not be acceptable. Chewings fescue, hard fescue, tall fescue and ryegrass shall contain *Acromonium* endophytes. Seed containing endophyte must be kept cool and dry at all times; do not stockpile in the sun.

D. Seed Mixture Composition for General Turf Conditions without Irrigation:

Common Name	Germination By Weight	Purity Minimum	Proportion Minimum
Creeping Red Fescue/ Chewings Fescue	50%	85%	95%
Kentucky Bluegrass	25%	85%	90%
Perennial Ryegrass	25%	90%	90%

1. Bluegrass and rye grass varieties shall be within the top 50 percent and 25 percent respectively, of varieties tested in National Turfgrass Evaluation Program, or currently recommended as low maintenance varieties by University of Massachusetts or the University of Rhode Island.

2. Seeding rate shall be 6 pounds per 1,000 square feet

2.04 FERTILIZERS

A. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. Fertilizer shall contain not less than the percentages of weight of ingredients as recommended by the soil analysis specified, performed and paid for under the Section, Planting Soils, of this Specification.

B. Phosphorus shall be superphosphate or triple superphosphate.

2.05 LIMESTONE

A. Ground limestone for adjustment of loam borrow pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 40 percent will pass through 100 mesh sieve and 95 percent will pass through a 20 mesh sieve. Contractor shall be aware of loam borrow pH and the amount of lime needed to adjust pH to specification in accordance with testing lab recommendations.

2.06 WOOD CELLULOSE FIBER MULCH

A. Mulch to cover hydroseeded areas with slopes less than 3 to one shall be fiber processed from whole wood chips and clean recycled newsprint in a 1:1 proportion manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper, or cardboard.

B. Moisture content shall not exceed 10 percent, plus or minus 3 percent as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than 900 grams water per 100 grams fiber.

C. The mulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.

D. The mulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be non-injurious to plant growth.

2.07 HERBICIDES, CHEMICALS AND INSECTICIDES

A. Provide chemicals and insecticides as needed for fungus or pest control. All chemicals and insecticides shall be approved by the Massachusetts Department of Food and Agriculture for

the intended uses and application rates.

B. Provide post emergent crab grass control throughout the maintenance period to ensure a germinated and mown lawn free of crab grass.

2.08 WATER

A. The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be responsible to furnish adequate supplies at his own cost. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

B. Contractor shall keep log of watering schedule and volume applied. Log shall be signed by Foreman and submitted to Landscape Architect.

PART 3 – EXECUTION

3.01 FILLING AND COMPACTION

A. Filling and compaction of loam shall be specified, performed and paid for under the work of the Section, Planting Soils, of this Specification.

3.02 FINE GRADING

A. Fine grading shall be specified, performed and paid for under the work of the Section, Planting Soils, of this Specification.

3.03 SEEDING

A. Contractor shall obtain Landscape Architect’s written approval of fine grading and bed preparation before doing any seeding.

B. Limit of grading and earthwork shall be limit of seeding unless otherwise indicated on the Contract Documents. All areas disturbed outside the limit of seeding shall be prepared and seeded as specified herein at no additional cost.

C. The season for seeding shall be from April 1 to June 1 and from August 15 to September 30. The actual planting of seed shall be done, however, only during periods within this season which are normal for such work as determined by weather conditions and by accepted practice in this locality. To prevent loss of soil via water and wind erosion and to prevent the flow of sediment, fertilizer, and pesticides onto roadways, sidewalks, and into catch basins, seed loam areas within 5 Days of spreading the loam.

D. Seed only when the bed is in a friable condition, not muddy or hard.

E. Seeding shall be by Hydroseeding Method specified as follows:

1. Prior to the start of work, furnish a certified statement as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding that can be covered with the quantity of solution in the hydroseeder.

2. Hydroseed with wood cellulose fiber mulch at a rate of 46 pounds per 1,000 square feet or 2000 pounds per acre.

3. For the hydroseeding process, a mobile tank with a capacity of at least 500 gallons shall be filled with water and the mixture noted above in the specified proportions. The resulting slurry shall be thoroughly mixed by means of positive agitation in the tank. Apply the slurry by a centrifugal pump using the hose application techniques from the mobile tank. Only hose application shall be permitted. At no time shall the mobile tank or tank truck be allowed onto the prepared hydroseed beds. The hose shall be equipped with a nozzle of a proper design to ensure even distribution of the hydroseeding slurry over the area to be hydroseeded and shall be operated by a person thoroughly familiar with this type of seeding operation.
4. Contractor shall obtain Landscape Architect's written approval of fine grading and bed preparation before doing any hydroseeding.
5. Limit of grading and earthwork shall be limit of hydroseeding unless otherwise indicated on the Contract Documents. All areas disturbed outside the limit of hydroseeding shall be hydroseeded.
6. Seed only when the bed is in a friable condition, not muddy or hard. Construction methods shall conform to hydraulic method requirements specified in the Standard Specification.
7. Hydroseeding shall be a two-step process.
    a. Step one shall consist of spreading 100 percent of the required seed uniformly over the prepared loam bed so that the seed comes into direct contact with the soil. To mark the progress of the hydroseeding operation the Contractor may add 10 percent of the wood cellulose fiber mulch to the slurry.
    b. Step two shall consist of a separate application of wood cellulose fiber mulch immediately following the first step of hydroseeding noted above. Apply the wood cellulose fiber mulch at a rate of 2,000 pounds per acre.

3.04 TURF MAINTENANCE

A. Maintenance shall begin immediately after any area is seeded and shall continue for a 90 day active growing period for seeded areas past Final Acceptance; the completion of all lawn construction work, and until final acceptance of the project.

1. In the event that seeding operations are completed too late in the Fall for adequate germination and growth of grass, then maintenance shall continue into the following Spring for the minimum 60 Day period. In addition, install blankets or netting to prevent loam degradation and movement over the winter. Submit product literature and samples to the Landscape Architect for review. Blankets and netting shall be placed in a timely manner at no additional cost to the Owner.
2. Contractor shall be responsible for the timely care and maintenance of the existing turf areas in the park from receipt of Notice to Proceed until Final Completion. Maintenance shall include mowing (turf shall not be allowed to grow longer than 4 inches).

B. Maintenance shall include reseeding , mowing, watering, weeding, fertilizing a minimum of two times in addition to the fertilizer incorporated by harrowing into the spread loam, and resetting and straightening of protective barriers. Lawn work maintenance shall also include chemical treatments as required for fungus and/or pest control.

C. During the maintenance period, any decline in the condition of seeded areas shall require immediate action to identify potential problems and to undertake corrective measures.

D. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment.

1. The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable lawn. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary to maintain moist soil to a depth of at least 2 inches for seeded areas. Begin watering immediately after seeding.

2. Watering shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply water to the required soil depths each 8-hour period.

E. Protection

1. Lawn areas shall be protected by a 4-foot high fence constructed with steel stakes set 18 inches in the ground at 10 foot intervals.
2. Barriers must be raised immediately after lawn construction and shall be maintained until Acceptance.

F. After the grass in seeded areas has germinated, reseed all areas and parts of areas that fail to show a uniform stand of grass. Reseed such areas and parts of areas repeatedly until all areas are covered with a satisfactory growth of grass with no less than 20 grass shoots per square inch and 2,880 grass shoots per square foot. Reseeding together with necessary grading, fertilizing, and trimming shall be done at the Contractor's expense.

G. Fertilizing: The first application of fertilizer is specified, provided, performed and paid for under the Section, Planting Soils.

3.05 APPLYING LIMESTONE

A. The Contractor shall return to the site at the beginning of the next seeding season and spread limestone across all lawn areas installed under this Contract. The work of liming the fields shall be as specified under Section, Planting Soils, of this Specification, and performed and paid for under this Section, TURF & GRASSES. Limestone shall be spread at rates determined by the soil tests specified, performed and paid for under Section, Planting Soils.

3.06 ACCEPTANCE

A. Acceptance of seeded turf and sod shall be in advance of contract Final Completion. If additional time is required for turf establishment, the Contractor shall notify the Landscape Architect in writing at least 60 days in advance of Final Completion.

B. Following the minimum required maintenance periods for lawn construction, the Contractor shall request the Landscape Architect in writing for a formal inspection of the completed work. Request for inspection shall be received by the Landscape Architect at least 10 days before anticipated date of inspection.

C. Acceptance Requirements

1. At the end of the maintenance period, seeded areas shall have a close stand of grass as defined above with no weeds present and no bare spots greater than 3 inches in diameter over greater than 5 percent of the overall seeded area. At least 90 percent of the grass established shall be permanent grass species. If seeded areas are deficient, the Contractor's responsibility for maintenance of all seeded areas shall be extended until deficiencies are corrected. Seeded areas to be corrected shall be prepared and reseeded in accordance with the requirements of this Section, TURF & GRASSES.

2. At the time of acceptance, the Contractor shall remove temporary barriers used to protect lawn areas.

D. Furnish full and complete written instructions for maintenance of the seeded areas to the Owner at the time of acceptance in conformance with Submittals requirements.

E. Landscape Architect's inspection shall determine whether maintenance shall continue in any part.

3.07 CLEAN UP

A. Absolutely no debris may be left on the site. Excavated material shall be removed as directed. Repair any damage to site or structures to restore them to their original condition, as directed by the Landscape Architect, at no cost to the Owner.

B. Clean wheels of vehicles before leaving site.

END OF SECTION 32 91 19
TURF & GRASSES